RESPONSE TO EPA INFORMATION REQUEST

FIRSTLIGHT POWER RESOURCES SERVICES, LLC
MT. TOM STATION

NPDES PERMIT NO. MA0005339

Prepared for:

FirstLight Power Resources Services, LLC

Prepared by:

Kleinschmidt
Energy & Water Resource Consultants

MAY 2011

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1.0 INTRODUCTION

By letter dated February 15, 2011, the New England Regional Office of the United States Environmental Protection Agency (USEPA or EPA) notified FirstLight Power Resources Services, LLC (FirstLight) that a draft National Pollutant Discharge Elimination System (NPDES) permit for their Mt. Tom Station (MTS) in Holyoke, MA was being developed. The current NPDES permit for MTS (Permit No. MA0005339) expired September 18, 1997. Since MTS applied for a NPDES permit reissuance in a timely manner, the permit was administratively continued until a new one is issued. Pursuant to Section 308 of the Clean Water Act (CWA), EPA requested additional information from FirstLight to support development of the reissued draft NPDES permit in their February 15, 2011 letter (*see* Appendix A).

In response to an earlier request by EPA via letter dated September 11, 2007, FirstLight submitted the "Cooling Water Intake Structure Information Document" (Kleinschmidt 2008a) to EPA in January 2008. This document served to clarify and update certain information submission requirements related to MTS's application for reissuance of its NPDES permit pertaining to the cooling water intake structure (CWIS) that is regulated under Section 316(b) of the CWA. Additional biological monitoring data were submitted to EPA in the "Impingement Monitoring Report" (Kleinschmidt 2008b), which was submitted in December 2008, and the "Ichthyoplankton Data Report" (Kleinschmidt 2010), which was submitted in November 2010.

Subsequent to receiving the February 15, 2011 letter from EPA, MTS participated in a conference call on March 2, 2011 that included representatives from MTS, their consultants (Kleinschmidt), EPA, and Massachusetts Department of Environmental Protection (MADEP). Based on the discussion during the call, MTS requested minor modifications to EPA's information request, which were formally submitted to EPA via letter dated March 8, 2011 (*see* Appendix A). The EPA responded to the modification requests via letter dated April 22, 2011 and amended their original information request based on changes proposed by MTS (*see* Appendix A). The information contained herein fulfills the EPA's information request based on the February 15, 2011 letter to MTS, the conference call mentioned above, the minor modification request letter (March 8, 2011) from MTS to EPA, and EPA's April 22, 2011 response letter to MTS.

The structure of this document corresponds to the order of information requests stipulated by EPA in the February 15, 2011 letter, such that responses to the thermal discharge information request are provided in Section 2, followed by responses to impingement and entrainment reduction best technology available information request in Section 3. References used in preparation of this document are listed in Section 4.

2.0 THERMAL DISCHARGE INFORMATION

2.1 ADDITIONAL THERMAL STUDIES

As discussed in the March 2, 2011 conference call with EPA, MTS is not in possession of any additional thermal studies conducted in the general area of Connecticut River at MTS, nor are we aware of any additional studies that may have occurred since 1974.

2.2 THERMAL PLUME ANALYSIS OF OUTFALL 001

MTS proposed modifications to the EPAs original request outlined in Section I(b) of the February 15, 2011 letter to allow for alignment with the plant heat transfer design capabilities of the station. Upon review of EPA's original request, as well as data obtained during a recent test of the plant's capabilities, it became clear that the scenarios requested to be analyzed were not feasible situations for MTS operations. Currently, when MTS operates at full load, the amount of heat discharged from the condenser to the cooling water system is approximately 6.3×10^8 BTU/hr. When operating at 100 percent power and using one circulating water pump (70 MGD), the delta T is approximately 26°F. When operating at full load with two circulating water pumps (133.2 MGD), the delta T is approximately 13°F. With this, MTS requested modifications to the four thermal discharge scenarios requested to be analyzed in EPA's February 15, 2011 letter. As proposed in the March 8, 2011 from MTS to EPA, the four scenarios analyzed were:

1) MTS discharge with a delta T of 26°F and a discharge temperature of 109°F during one pump operation using one circulating water pump and one river water pump (70 million gallons per day (MGD). These operational conditions shall take place during warm weather summer period (air temperature 95°F) accompanied by low flow conditions in the Connecticut River (approximately 3,000 cfs).

2) MTS discharge with a delta T of 26°F and a discharge temperature of 103°F during one pump operation using one circulating water pump and one river water pump (70 MGD). These operational conditions shall take place during representative spring (April-May) conditions (air temperature 65°F) accompanied by spring flow conditions in the Connecticut River (approximately 15,000 cfs).

3) MTS discharge with a delta T of 13°F and a discharge temperature of 96°F during two pump operations using two circulating water pumps and two river water pumps (140 MGD). These operational conditions shall take place during warm weather summer period (air temperature 95°F) accompanied by low flow conditions in the Connecticut River (approximately 3,000 cfs).

4) MTS discharge with a delta T of 13°F and a discharge temperature of 90°F during two pump operations using two circulating water pumps and two river water pumps (140 MGD). These operational conditions shall take place during representative spring (April-May) conditions (air temperature 65°F) accompanied by spring flow conditions in the Connecticut River (approximately 15,000 cfs).

The extent of the MTS thermal plume was developed from expert information and modeled using CORMIX. CORMIX, also known as the Cornell Mixing Zone Expert System, is a software system specially designed for the analysis of mixing problems and was used to predict the extent of the thermal plume under various operational and river flow scenarios. Supplemental information included bathymetric and thermal profiles from the 1974 Thermal Plume Study and information collected by the EPA in August 2010. Other data, such as the intake and discharge flow rates, discharge temperature, and discharge geometry were assembled from currently available station data.

Models were developed under a series of seasonal conditions, which included flow rates and associated ambient temperatures. Previous thermal plume efforts have determined the domain of the modeling effort. The CORMIX model requires a distance downstream of at least ten times the river width, thus approximately 2,000 meters downstream; however, the effects of the plume as observed in the field are marginalized at this distance. The model was calibrated with data collected from previous studies, including ambient temperatures, discharge temperatures and flow rates. These studies include a 1974 Thermal Plume Study conducted by the Holyoke Water Power Company during a low flow and mid flow condition, in addition to data collected by the EPA in August 2010.

Model Scenario	Delta T (°F)	Station Flow (MGD)	River Flow (cfs)	Ambient Water Temp. (°F)	Discharge Water Temp. (°F)	Plan View Figure #	Longitudinal Profile Figure #
1	13	70	3,000	77	90	1	17A
2	13	70	3,000	83	96	2	17B
3	13	70	15,000	77	90	3	17C
4	13	70	15,000	83	96	4	17D
5	13	140	3,000	77	90	5	18A
6	13	140	3,000	83	96	6	18B
7	13	140	15,000	77	90	7	18C
8	13	140	15,000	83	96	8	18D
9	26	70	3,000	77	103	9	19A
10	26	70	3,000	83	109	10	19B
11	26	70	15,000	77	103	11	19C
12	26	70	15,000	83	109	12	19D
13	26	140	3,000	77	103	13	20A
14	26	140	3,000	83	109	14	20B
15	26	140	15,000	77	103	15	20C
16	26	140	15,000	83	109	16	20D

Model results included detailed mapping of the thermal plume in plan and longitudinal view under the various ambient river scenarios with an isotherm of delta 1.5°F (*see* Appendix B, Figures 1 - 20). However, post processing was required for mapping. The CORMIX model generated coordinates and geometry in an arbitrary datum with the discharge at the origin, and the output does not take into account localized rotation in the direction of cumulative flow or as the plume becomes bank-attached. Post processing, rotation, and projection were conducted using computer software. The discharge was projected onto Massachusetts State Plane NAD 1983 at N: 829983.9563, E: 108965.3866. The plume was then rotated in the polar direction of cumulative flow (5.2942 radians) until it was bank-attached. As the plume becomes bank-attached, the point of reference changes allowing for localized origins and rotation parameters. The local bank origins and rotation parameters in radians were calculated using the ESRI ArcMap 9.3.1 Coordinate Geometry tool. After post-processing, the plumes were imported into ArcMap, projected into Massachusetts State Plane coordinates and mapped.

2.3 POTENTIAL IMPACTS TO AQUATIC HABITAT

MTS is located in the Connecticut River Valley eco-region, which has relatively rich floodplain soils and level terrains with some higher ridges. The river at MTS is wide with fairly deep water, fine sediments and extensive floodplains where flooding occurs annually. Sediment characteristics in this reach of the river include mean grain size ranging from 0.16 to 0.82 mm, percent silt/clay ranging from about 7% to just less than 1%, and percent organic content that ranges from 1.6% to 0.5% (HWP 1997).

There are seven species of freshwater mussels present in this area of the river. These include the Eastern elliptio, triangle floater, Eastern floater, Alewife floater, tidewater mucket, Eastern lampmussel, and the yellow lampmussel (Nedeau 2008). Of these, the triangle floater and the tidewater mucket are listed as special concern in Massachusetts and the yellow lampmussel is listed as endangered in Massachusetts (Nedeau 2008). Benthic invertebrate sampling was conducted in the immediate area of MTS as part of the Holyoke Dam relicensing in August 1995 and May 1996. The infaunal communities consist of a variety of organisms including a number of different species of worms, midges, mayflies, and stoneflies (HWP 1997). There are also protected species in the riparian zone along this reach of the river including a number of plants, insects, amphibians, reptiles and birds. Most notable are the shortnose sturgeon (federal and Massachusetts endangered), Puritan tiger beetle (Massachusetts endangered, federal threatened), cobra clubtail dragonfly (Massachusetts special concern), and the tufted hairgrass (Massachusetts endangered).

Shortnose sturgeon

The Holyoke Dam separates shortnose sturgeon in the Connecticut River into an upriver group (above Holyoke Dam) and a lower river group that occurs below Holyoke Dam to Long Island Sound. The abundance of the upriver group has been estimated by mark-recapture techniques using Carlin tagging (Taubert 1980) and PIT tagging (Kynard unpublished data). No information exists on the historical numbers of shortnose sturgeon in the Connecticut River prior to the late 1970s. Estimates of total abundance calculated in the early 1980s range from 297 to 516 in the upriver population to 800 in the lower river population. Population estimates conducted in the 1990's indicated populations in the same range. Savoy (2004) estimated that the lower river population may be as high as 1,000 individuals, based on tagging studies from 1988-2002. Other estimates of the total adult population in the Connecticut River have reached 1,200 (Kynard 1998), and based on Savoy's estimate, the total population may be as high as 1,400 fish.

Many years of studies by Dr. Boyd Kynard from the USGS Conte Anadromous Fish Laboratory demonstrate that shortnose sturgeon spawn about 20 miles upstream in Montague City, Massachusetts. Sturgeon eggs are demersal and adhesive and larvae do not disperse far downstream from their local spawning grounds. Shortnose sturgeon are believed to spawn at discrete sites within a river (Kieffer and Kynard 1993). Kieffer and Kynard (1993) determined that adults spawned within a 2-km reach in the Connecticut River for three consecutive years. Spawning occurs over channel habitats containing gravel, rubble, or rock-cobble substrates (Dadswell et al. 1984; NMFS 1998). Additional environmental conditions associated with spawning activity include decreasing river discharge following the peak spring freshet, water temperatures ranging from 8-12°C, and bottom water velocities of 0.4 to 0.7 m/sec (Dadswell et al. 1984; NMFS 1998). Individual eggs are initially discrete when spawned but become adhesive within approximately 20 minutes of fertilization (Dadswell et al. 1984). Between water temperatures of 8 and 12°C, eggs generally hatch after approximately 13 days. The larvae are photonegative, remaining on the bottom for several days. Buckley and Kynard (1981) found week-old larvae to be photonegative and form aggregations with other larvae in concealment.

At hatching, shortnose sturgeon are blackish-colored, 7-11 mm long, and resemble tadpoles (Buckley and Kynard 1981). In 9-12 days, the yolk sac is absorbed and the sturgeon develop into larvae, which are about 15 mm total length (TL; Buckley and Kynard 1981). Sturgeon larvae are believed to begin downstream migrations at about 20 mm TL. Laboratory studies suggest that young sturgeon move downstream in a two-step migration: a 2 to 3-day migration by larvae followed by a residency period by young of the year (YOY) fish, then a resumption of migration by yearlings in the second summer of life (Kynard 1997). Adult sturgeon occurring in freshwater or freshwater tidal reaches of rivers in summer and winter often occupy only a few short reaches of the total length (Buckley and Kynard 1985).

In the Connecticut River, shortnose sturgeon exhibit three distinct movement patterns. These migratory movements are associated with spawning, feeding, and overwintering activities. In spring, as water temperatures rise above 8°C, pre-spawning shortnose sturgeon move from overwintering grounds to spawning areas. Spawning occurs from mid/late March to mid/late May depending upon location and water temperature. Shortnose sturgeon spawning migrations are characterized by rapid, directed and often extensive upstream movement (NMFS 1998).

Shortnose sturgeon in the Connecticut River reach sexual maturity at approximately age 8. In the Connecticut River, Buckley and Kynard (1985) found that spawning lasted 2-5 days in 1980-1992, and Kynard (1997) noted that spawning lasted 7-13 days in 1989-1993. Shortnose sturgeon spawn in the Connecticut River from the last week of April to mid-May; after peak spring flows and in moderate, decreasing river discharge (Taubert 1980; Buckley and Kynard 1985; Kynard 1997).

One foraging area is located above Holyoke Dam and four others are located below Holyoke Dam. The migration of juvenile and adult shortnose sturgeon to points downstream of the Holyoke Dam appears to be a natural event coincidental with increased river discharges (Seibel 1991; Kynard 1997). The concentration areas used by adult fish in the Connecticut River are in reaches where natural or artificial features cause a decrease in river flow, possibly creating suitable substrate conditions for freshwater mussels (Kieffer and Kynard 1993), a major prey item for adult sturgeon (Dadswell et al. 1984). Both adults and juveniles have been found to use the same river reaches in the Connecticut River and have summer home ranges of about 10 km (Savoy 1991; Seibel 1991). The wintering range is usually less than 2 km, with fish congregating in deep areas, usually within or near the summer range (Seibel 1991). Foraging adults prefer curved or island reaches in the summer, not straight runs, and appear to prefer gravel and rubble substrate in the summer but sand in the winter. Fish foraging activity is almost equal during day and night but most adult sturgeon occur in slightly deeper water during the day than at night.

From 2006 through 2009, a multi-year study was conducted to determine the shortnose sturgeon routes of passage at Holyoke Dam as a relicensing requirement (Normandeau 2010). During 2006, gill net sampling was conducted in the reach of the river near MTS starting at the Holyoke Dam and moving progressively upstream. No shortnose sturgeon were collected in this reach of the river. Collection efforts in subsequent years were concentrated in three primary areas, near Hatfield, Sunderland/Montague, and near the mouth of the Deerfield River, Massachusetts. A total of 57 shortnose sturgeon were collected and tagged during 2007-2009; however, none was detected near MTS nor Holyoke Dam. Adult and juvenile shortnose sturgeon are most likely occasional transients in the vicinity of MTS and larvae are not expected in the area since their life history strategy involves only a short downstream migration from the spawning site over 20 miles upstream followed by a residency period until their second summer of life (Kynard 1997).

Atlantic salmon

Atlantic salmon were eradicated from the Connecticut River watershed over 100 years ago. Since 1967 efforts have been made to restore this species to the river. Atlantic salmon are anadromous, migrating from the ocean to freshwater specifically to reproduce. Atlantic salmon spawn in the fall, but often enter freshwater during the preceding spring, remaining downstream of spawning areas until fall. Upstream movement is often triggered by increases in river discharge. If allowed to spawn naturally, they do so in gravel substrates in the headwaters of tributaries, where the female digs a nest. The female deposits eggs in the nest, the eggs are fertilized, and then the female buries the eggs in the gravel. In self-sustaining wild populations of Atlantic salmon, the eggs develop in the nest, also known as a redd, and the fry hatch during the following spring. The fry remain buried in the gravel until the yolk-sac is absorbed, then they emerge and inhabit fast-flowing water. As they develop, the young are called parr and remain in freshwater for two or three years before they migrate to the sea as smolts, which are generally 150 to 200 mm long. Most of this freshwater phase occurs in the natal tributary, although some downstream movement prior to the seaward migration is known to occur in some populations. The seaward migration usually takes place in spring when water temperature reaches about 10°C, during or immediately following spring runoff.

In the Connecticut River, only one of ten salmon is released from the Holyoke fish lift to proceed upstream. Some of these fish are subsequently captured at upriver sites; others remain free and may spawn naturally. The remainder are trapped at the Holyoke fish lift and transported to adult holding facilities where they are kept until spawning season. Thus about 10% of adult salmon returning to the Connecticut River migrate past the Holyoke Dam and MTS and some of those may migrate back downstream past MTS after spawning.

Since few adults are allowed to migrate past MTS and eggs and larvae of those that do stay in tributaries until they migrate, these life stages are not vulnerable to impingement and entrainment. The restoration effort relies on stocking of fry and smolts, which are released upstream of MTS. In 2010, 6.1 million fry and almost 1 million smolts were released upstream of MTS in the Connecticut River. No fry and only 14 salmon smolts of the millions released upstream were collected in the two-year study at MTS.

American shad

American shad are native to the Connecticut River, where their range extends from Long Island Sound to as far north as the impoundment above Bellows Falls Dam (175 miles upstream). American shad are anadromous, migrating from the ocean to freshwater specifically to reproduce. Adult shad enter the river in the spring, generally reaching the Holyoke Dam in late April to early June (Hartel et al. 2002). Spawning occurs in the Connecticut River mainstem and larger tributaries in the spring. Juveniles remain in spawning areas until their seaward migration in late summer and fall.

Eggs (about 290,000 per female) are broadcast and fertilized in open water in a variety of habitats in the mainstem Connecticut. After spawning, spent shad swim back downstream, primarily during daylight hours during June and July, and may survive to spawn more than once. The larvae hatch in 3 to 12 days, depending on water temperature. The yolk-sac is absorbed in another 3 to 4 days, and the larvae are transported by currents into areas of lower velocity, where they begin to feed.

Young-of-the-year shad are abundant in many locations in the area of MTS throughout the summer. Presumably they provide a forage base of some importance for predatory fish in the area. Juvenile shad migration out of the Connecticut River occurs in September through November, peaking when water temperature is 9 to 14^{o}C.

On December 22, 2010, US Fish and Wildlife Service (USFWS) sent a letter to EPA with comments on the MTS ichthyoplankton report (*see* Appendix A). In the letter, USFWS questioned the American shad equivalent adult estimate and suggested that the adult equivalent losses were higher than calculated. In response, the American shad equivalent adult losses were recalculated using lifestage specific survival rates as suggested by USFWS and these results were then compared to the shad adult equivalent losses in the ichthyoplankton report.

The methods used to evaluate entrainment at MTS follow the methods described by the EPA for the *Regional Analysis Document for the Final Section 316(b) Phase II Existing Facilities Rule* (Phase II Rule). The Phase II Rule standardized impingement and entrainment rates using common biological metrics so that rates could be compared across species, years, facilities and geographic regions. The EPA derived three loss rates applicable to all life stages: (1) foregone age-1 equivalents, (2) foregone fishery yield, and (3) foregone biomass production (USEPA 2004b). The first method, foregone age-1 equivalents, commonly referred to as the Equivalent Adult Model (EAM) is one of the most widely used approaches for estimating the effect of cooling water withdrawal on the mortality of aquatic organisms at power plants (EPRI 1999). This method provides a mechanism to extrapolate estimates of the direct loss of various lifestages for a species to an equivalent number of organisms lost at some other lifestage, and was the method used for the MTS analysis. The equivalent losses are calculated with the EAM using estimates of lifestage specific power plant related losses and estimates of lifestage specific total mortality rates (Equation 1;EPRI 1999).

$$AEL = \sum_{j=1}^{n} S_{i,A} N_i \quad \text{(Equation 1)}$$

Where:

N_i = number of fishes lost at stage *i*; and

$S_{i,A}$ = fraction of fishes expected to survive from age *i* to the age of equivalence.

The lifestage-specific entrainment rates were calculated from the results of sampling which occurred between 2009 and 2010 at the MTS facility. All lifestage-specific mortality rates were gathered from the EPA Inland Region Appendix H (USEPA 2004b). The age of equivalency can be any lifestage of interest (USEPA 2004b). Survival rates of early lifestages are often expressed on a lifestage-specific basis so that the fraction surviving from any particular lifestage to adulthood is expressed as the product of survival fractions for all lifestages through which a fish must pass before reaching adulthood (j_{max} = the stage immediately prior to the age of equivalence):

$$S_{i,A} = \prod_{j=i}^{j_{\max}} S_j \quad \text{(Equation 2)}$$

Where:

S_j: Lifestage specific survival fraction.

The lifestage-specific survival rates used for the MTS EAM were calculated from the Inland Region mortality rates used by the EPA for the Phase II Rule. Stage-specific survival fractions and mortality rates are linked by the following mathematical relationship (Equation 3; USEPA 2004b):

$$S_j = e^{-Zj} \text{ (Equation 3)}$$

Where:

Z_j = stage-based instantaneous mortality rate for stage j.

The stage based instantaneous mortality rate is the sum of the species specific natural and fishing mortality rates.

The age-specific survival fractions used for the MTS EAM can be interpreted as the proportion of individuals expected to survive from the end of the previous lifestage until the end of the current stage as identified by each column (see table below). The expected survival from the larval stage to each successive lifestage is calculated using Equation 2 and is simply the product of the lifestage specific survival rates. If the age of equivalency is specified, the equivalent number of individuals expected to survive until the end of that lifestage is the product of the MTS entrainment rate and the lifestage specific survival rate. The 2009 results of the Equivalent Adult Model can be found in the table below and can be interpreted as the number of individuals expected to survive to adults if they were not entrained at MTS.

The lifestage-specific survival rates published by the EPA and used for the MTS Entrainment Analysis were compared to age based survival rates developed by the Connecticut Department of Environmental Protection (CT DEP) specifically for the Connecticut River shad population. Year to year variability resulted in CT DEP calculating a range of mortality rates for shad larvae. The CT DEP calculated mortality rates ranged from a high of 26% and a low of 4% mortality (Crecco et al. 1983). Connecticut River specific juvenile shad mortality rates were calculated to be between 1.5 to 2.5% per day by Savoy et al. (2004). Although the mortality rates among the sub-adult shad in the ocean has not been directly estimated, Savoy et al. (2004) theorized that oceanic mortality ranges were 30% to 40% per year. These mortality rates were converted to age-specific survival fractions and applied to the 2009 MTS clupeid entrainment estimate to calculate the number of clupeids expected to survive to the end of each lifestage (see table below). This comparison demonstrated that the EPA survival rates were comparable to the CT DEP Connecticut River specific survival estimates and the number of shad expected to survive calculated from the EPA survival rates fell between the high and low CT DEP estimates.

Estimate	Number of Larvae Entrained	Number expected to survive at the end of each lifestage								
		Larvae	Juvenile	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
Low*	317,569	97,208	889	876	613	429	300	210	147	103
High**	317,569	51	0	0	0	0	0	0	0	0
EPA***	317,569	13,206	25	19	14	10	4	1	0	0

*Crecco, et al. 1983
**Savoy et al. 2004
***USEPA 2004b

River herring

River herring is a term used to collectively refer to alewife and the blueback herring. However, only blueback herring are found in the river at MTS as alewife stay in waters closer to the coast and do not migrate that far upstream. Blueback herring enter the Connecticut River to spawn at about the same time as American shad. Peak blueback movement often occurs slightly after peak shad movement. They are not an important sport or commercial species in the Connecticut River, although some are captured for use as bait in coastal fisheries, and they are harvested at sea for human consumption, as well as for animal feed, etc. They spawn on hard substrate in swift-flowing tributaries to the lower Connecticut River at temperatures of 14°C to 25°C. Females may produce 122,000 to 261,000 eggs; larger fish generally produce more eggs. The eggs are adhesive when they are first deposited, but drift downstream from spawning areas after they become water-hardened. The adults migrate back downstream immediately after spawning, and are capable of returning to spawn in subsequent years.

The larvae continue to drift downstream as development proceeds. Juveniles remain in the river, feeding on zooplankton, until fall of the year of hatching. They then migrate to sea. These characteristics of their development parallel those of American shad and the young of the two species are difficult to distinguish without excessive handling. Juvenile blueback herring begin their seaward migration slightly earlier and at higher water temperatures (peaking at 14°C to

15°C) than American shad. Adult blueback spend three to six years at sea before returning to spawn in their natal streams. The average length of adults is less than 300 mm.

The first few blueback herring were counted in Holyoke in 1957. The numbers increased sharply in the 1970s, and in 1985, about 632,000 were counted at the dam. In the 1990s, though, the returns of blueback herring fell dramatically, going from 411,000 in 1991 to 2,700 in 1997 to fewer than 100 since 2006. Considering the low numbers of blueback herring in the vicinity of MTS, little impingement and no entrainment impact is expected.

Impacts

A number of technologies are being evaluated to determine impingement and entrainment impact reductions at MTS. Some of the technologies require construction or deployment in the Connecticut River near the cooling water intake tunnel. The expected impacts from construction or benthic disturbance in the river that may occur as part of the installation and operation of evaluated technologies are discussed below.

EPA selected a suite of technologies and operational measures for further analysis at MTS, including mechanical draft cooling towers, year round flow reduction, May and June flow reduction, fish return system upgrade, barrier net (aquatic filter barrier), cylindrical wedge wire screens, and expanded river cooling water intake structure. Of these, barrier net (aquatic filter barrier), cylindrical wedge wire screens and expanded river cooling water intake structure have the potential to create impacts and disturbances in the river. In addition, mechanical draft cooling towers and fish return system upgrade may also have a potential to impact habitats within the riparian zone along the river.

Aquatic Filter Barrier Net

A site-specific analysis (*see* Section 3.8) determined that 800 feet of aquatic filter barrier with anchors on both sides every thirty feet would need to be installed at MTS. Both the barrier itself and the anchors would directly impact the benthic habitat and most likely increase turbidity during deployment. This barrier would be set in a semi-circle surrounding the intake cutting off access to over two acres of river habitat. This would eliminate the use of this area as spawning and nesting habitat. If the barrier is installed in May, June and July when most of the entrainment occurs, there is a potential to strand fish behind the barrier. A barrier of this size may alter the hydrology of the immediate area.

In-water studies of the Gunderboom (*see* Section 3.8) have revealed that fouling is an issue with these barriers (Henderson et al. 2001). Velocity hot spots can form as the result of fouling and lead to planktonic organisms be pinned to the mesh causing egg and larval mortality. As a fouling community develops on the barrier, a predatory community can become established, which feed on weak swimming or non-swimming eggs and larvae, also increasing mortality (Henderson et al. 2001).

Wedge Wire Screens

An analysis for installation of 0.5-mm cylindrical wedge wire screens at MTS revealed that six, 7-foot diameter wedge wire screens, 25 ft in length would be required at the MTS site (*see* Section 3.9). A 14-ft depth of water would be needed (1/2-diameter clearance on all sides) and since the depth of the Connecticut River in front of the CWIS entrance is 15 ft at mean low water, the screens would need to be installed further offshore in deeper areas to ensure submersion during low flow periods. The screen footings would have direct impacts on the benthic habitat and may directly impact benthic organisms and mussels. Installation of the new screens in the water body may impact yellow lampmussel habitat in the benthic environment of the river. Construction impacts would include increased turbidity and placement of the screens may result in changes in the hydrology in the MTS reach of the river. If cylindrical wedge wire screens are installed further offshore from the facility, the screens would be closer to the river channel. This could lead to navigation conflicts as well as increased fisheries impacts. A study performed by Kynard et al. (2003) in the vicinity of MTS indicated that fish abundance increases towards the channel.

Expanded Intake

An expanded intake concrete structure with sheetpile walls could be installed in front of the existing 8-foot diameter intake pipe at MTS to reduce intake velocities. The new intake could reduce the intake velocity to below 0.5 fps at both the intake pipe and the intake structure. Impacts would include, at minimum, a displacement of benthic flora and fauna due to dredging and other activities associated with construction, increased turbidity during the period of work, and limits to navigation in the area of construction. The habitats of a number of endangered species could be impacted including endangered mussels and shortnose sturgeon migration routes.

If construction occurs within the riparian zone along the Connecticut River, endangered dragonfly species, as well as a number of listed plant species could be impacted.

3.0 IMPINGEMENT AND ENTRAINMENT REDUCTION BEST TECHNOLOGY AVAILABLE INFORMATION

3.1 UPDATED FACILITY INFORMATION

EPA has requested that their Preliminary 316(b) Technology Feasibility Review (Attachment I of the February 15, 2011 letter) be reviewed, updated, and corrected as necessary. As discussed above in Section 2.2, the maximum delta T capable at MTS has been determined to be 26°F. Therefore, the paragraph of Section 1 (Overview of Current MTS CWIS Characteristics), which discusses the screen wash and fish return systems, should be revised to say that "the spray wash water has a temperature increase (delta T) of up to *26°F* from ambient water in the river."

Other than the additional information provided in the following sections of this document, MTS does not propose any further changes to the Preliminary 316(b) Technology Feasibility Review.

3.2 UPDATED COST INFORMATION

The costs provided in the 2008 MTS Cooling Water Intake Structure Information Document were based on 2007 dollars. To update to 2011 dollars, the costs provided in Attachment I of the February 15, 2011 EPA letter were multiplied by 1.34.

Measure	Additional Cost Per Year
Current Operation/Technology	$0
Mechanical Draft Cooling Towers	$5,557,955
Year Round Flow Reduction	$2,090,437
May-June Flow Reduction	$1,045,219
Fish Return System Upgrade	$164,619
Barrier Net	$102,256
Wedge Wire Screens (3-mm)	$624,899
Expanded River CWIS	$536,178

As indicated in Attachment I, these costs include capital and O&M costs annualized over the life of the technology and assume a 7.6% discount rate.

3.3 MECHANICAL DRAFT COOLING TOWER SITING

The MADEP consent order to cap and clear cut the northern sector of the MTS property would not necessarily preclude installation of mechanical draft cooling towers in that area. Two types of solid waste (coal ash and trash) will be capped on the MTS site. If a cooling tower is proposed to be built on the capped area, either type of solid waste will require a MADEP Post Closure Use Application to ensure that the cap is not compromised. If the area proposed for a cooling tower contains trash, then the trash will need to be excavated and removed before any building could occur. If the targeted area contains just coal ash, then the cooling tower can be built upon approval of the MADEP Post Closure Use Application without having to remove the coal ash.

3.4 MECHANICAL DRAFT COOLING TOWER DISCHARGE WATER VOLUME AND CHARACTERISTICS

The EPA requested information regarding the volume of discharge water expected and the thermal and chemical characteristics of the discharge each month using a mechanical draft cooling tower closed cycle cooling system at MTS. In the March 2, 2011 conference call with EPA and MADEP, MTS proposed to estimate the cooling tower discharge volume and thermal and chemical characteristics for the two worse-case scenarios of winter and summer, as the volume and physical characteristics of the discharge water for remaining months of the year would fall in between these two extremes. MTS formally requested evaluating only the two worse-case scenarios in the March 8, 2011 minor modification letter to the EPA; however, in their response letter (April 22, 2011) to MTS regarding the requested modifications, EPA amended their original request as follows:

> *Provide information regarding the volume of discharge water expected and the specific thermal and chemical characteristics of the discharge <u>each month</u> using a Mechanical Draft Cooling Tower(s) closed cycle cooling system at Mount Tom Station. Include the dimensions and thermal characteristics of the reduced thermal plume in the Connecticut River for one winter and one summer condition.*

Inflow requirements and discharge from the cooling tower were provided from cooling tower systems vendor for the two extreme cases of summer and winter. That is, minimum cooling tower flow was obtained for January/February and maximum cooling tower water usage was obtained for summer based on July, August and September flow rates. Because MTS was initially designed and operated as a base load plant, it was assumed that plant generation would be at or near full capacity (i.e., 100 percent output). With stable heat removal requirements, the variables for heat removal from the plant to the river water would be primarily that of river water temperature and the number of cooling tower cells in operation.

The cooling tower configuration assumes that the entire cooling tower arrangement consists of 21 cooling tower cells. During summer operation, all 21 cells would be utilized to maintain operation of the plant. During the winter, operation of at least 11 of the 21 cells would be necessary to support operation of the plant at 100 percent power. The periods between the maximum flow and the minimum cooling tower flow would therefore be based on expected river water temperature and historical plant flow requirements.

The amount of river water used by the cooling tower cells is dependent upon plant capacity, river water inlet temperature, river water composition, ambient air temperature, wet bulb temperature and the number of cooling tower cells operating. In order to provide reasonable estimates for river water flow, the outflow water temperature was defined as remaining constant (98°F) and the number of cells being used was selected based on river water temperature.

Month	No. Cooling Tower Cells	Estimated Intake Flow (gpm)	Estimated Discharge Flow (gpm)
January	11	1,025	525
February	11	1,025	525
March	11	1,025	525
April	12	1,180	604
May	14	1,370	702
June	19	1,860	953
July	21	2,050	1,050
August	21	2,050	1,050
September	21	2,050	1,050
October	17	1,660	850
November	11	1,025	525
December	11	1,025	525

These data assume approximately two cycles of concentration and minimal sediment amounts in the intake water. The chemical characteristics of the discharge water have not been specifically examined, as the type of treatment required depends on the composition of the intake water. In general, chemicals are added to cooling tower systems for the following reasons:

- Mitigation of biofouling with cooling tower fill and on heat exchanger surfaces;
- Mitigation of deposition of suspended matter on heat exchanger surfaces;
- Control of corrosion of wetted system materials; and
- Minimization of scaling precipitated salts on heat exchanger surfaces.

Depending on the composition of the make-up water, the resulting chemistry of the circulating water may have corrosive properties, which can be mitigated by maintaining a sufficient concentration of corrosion inhibitor within the system. The most common corrosion inhibitors in use are phosphates, which not only inhibit corrosion, but also scale formation. Depending on the selection of treatment that would be appropriate for application in the MTS closed cycle cooling system, slightly elevated levels of chemicals used to inhibit corrosion and scale formation may be present in the discharge water.

The reduced thermal plume expected from the use of mechanical draft cooling tower(s) closed cycle cooling system at MTS was mapped similarly to those presented in Section 2.2. The following table provides information regarding the volume and temperature of intake and discharge water under the two scenarios based on consultation with a vendor of cooling tower systems:

Parameter	**Summer**	**Winter**
Intake water temperature	82°F	50°F
River flow	5,000 cfs	20,000 cfs
Total evaporation and drift losses	1,000 gpm	500 gpm
Total blowdown	1,050 gpm	525 gpm
Total intake flow	2,050 gpm	1,025 gpm
Total discharge	1,050 gpm	525 gpm
Discharge temperature	98°F	98°F

Data presented in the table above were used in the CORMIX model that was developed to analyze thermal discharges at MTS and maps depicting the dimensions of the resulting plume under the two scenarios for cooling tower operation are provided in Appendix B (see Figures 21 - 23). Figures 21 and 23A depict the expected cooling tower plume under summer conditions and Figures 22 and 23B represent the plume for winter conditions.

3.5 ONE-PUMP SEASONAL OPERATION COSTS AND IMPACTS

The yearly cost estimate related to maintaining one-pump operation in May and June while still meeting delta T and maximum temperature discharge limits now in effect is based on the lost revenue due to reduced plant output. As discussed in the 2008 Cooling Water Intake Information Document, maintaining one-pump operation in June would require reducing station output by 21 percent, and it is estimated that station output would need to be reduced by 15 percent in May to maintain one-pump operation for the entire month. Assuming a revenue rate of $0.04/kWh, the annual cost estimate for one-pump operation in May and June is approximately $1.55 M in lost revenue for the station. One-pump operation year round was estimate to cost about $4M in lost revenue (Kleinschmidt 2008a).

The EPA requested MTS to assess the potential impacts of one-pump operation in May and June with a delta T of 32°F and a maximum discharge temperature of 115°F. As previously discussed, in Section 2.2, one-pump operation with the currently installed equipment at MTS results in a maximum delta T of 26°F. Therefore, unless new equipment is installed at the facility, a delta T of 32°F and maximum discharge temperature of 115°F are not feasible scenarios to consider for the current facility.

Entrainment reductions were calculated for one-pump operation year round and one-pump operation in May and June. Both of these scenarios assume that the reduction of larvae is equal to the reduction of water flow. Since MTS was in an outage for most of May 2009 (Kleinschmidt 2010) the entrainment reductions were calculated based on only the 2010 data. The reduction of the number of larvae entrained under the 1- pump year round operation scenario was estimated to be 4,026,377 larvae, which equal a 38% reduction. For the 1-pump operations during May and June scenario the reduction in the number of larvae entrained was estimated to be 4,038,624 larvae, which was equal to a 39% reduction. The percent reduction for these two scenarios was similar because more than 99% of the entrainment occurs during the period of May to July (Kleinschmidt 2010). MTS schedules an annual 2-week outage during early May. Since entrainment at MTS is highly seasonal (Kleinschmidt 2010), moving the annual outage from early May to early June would reduce entrainment by an estimated 80%.

3.6 VARIABLE SPEED PUMPS

The EPA requested information regarding the percentage of excess capacity of the cooling water intake pumps at MTS to assess the potential for reduction in cooling water use through the use of variable speed pumps and the corresponding expected reductions in entrainment and impingement. Since fish eggs and early-stage larvae behave as passive particles in the water body, the relationship between flow and entrainment is highly linear, such that a percent reduction in the volume of cooling water will essentially correlate to the same percent reduction in entrainment (Henderson and Seaby 2000). Flow volume has a less direct effect on impingement, whereby the relationship between flow rate and the number of organisms impinged is not linear (Henderson and Seaby 2000). For impingement, intake velocity is more influential than volume, as it exerts a direct physical force in the immediate area of an intake against which fish and other organisms must act to avoid the CWIS. As such, the use of variable speed pumps for reducing impingement will depend on whether and to what extent intake velocities will decrease with the reduction in flow.

Based on the recent entrainment monitoring study conducted at MTS, more than 99 percent of the annual entrainment occurs during the May-July period, so the use of variable speed pumps for reducing entrainment would only be effective if excess cooling water is used during that three-month period. Since MTS conducts their annual maintenance outages in May, flows have historically been much lower than design capacity during that month as no cooling water is used for the duration of the outages. For example, the average daily flow for the month of May based on last four years (2007-2010) is approximately 44 MGD, which is nearly 67 percent less than the design flow. Thus, variable speed pumps would not provide any entrainment reduction benefits for the duration of the outage in May.

With the exception of the last two years, MTS has typically operated as a base-load facility with capacity factors generally greater than 80 percent. Based on cooling water flows from 2007-

2010, MTS typically begins two-pump operations at the end of April or beginning of May and continues through the end of October, which is required to maintain plant operating efficiency, load, and discharge temperature limitations due to the elevated water temperatures of the Connecticut River during those months. Average water temperatures of the Connecticut River in the vicinity of MTS are as follows:

Month	Average Temp.* (°F)
May	60.7
June	70.1
July	76.4

*Based on MTS intake water temperature sensor.

When operating at maximum capacity in July, MTS requires the maximum capacity of the cooling water pumps, so variable speed pumps would not provide any benefit. Since no entrainment reductions would be realized through the use of variable speed pumps in both May and July, it does not appear that the costs for installing variable speed pumps at MTS are proportional to the benefits that would potentially be realized for reducing flow in June alone.

3.7 UPGRADED FISH RETURN SYSTEM AND LARGER SCREENS

The capital cost for upgrading the current fish return system at MTS is estimated to be $215,000. This cost includes two new screen wash pumps and motors; a one-foot diameter buried HDPE pipe extending from the return trough at the substation fence to the riverbank, at which point the exposed portion of the pipe will be constructed of steel and extend to the river side of the existing sheetpile wall of the discharge area; and engineering, permitting and construction costs. Annual O&M costs are not expected to be different than what is currently incurred by the station for operation of the existing screen wash pumps and fish return sluice.

Based on EPA’s Technical Development Document (USEPA 2004a), the estimated cost for modifying the intake structure to accommodate larger screens is $5.8M. This cost includes construction of a new, larger intake structure in front of the existing intake to decrease downtime and allow for continued operation of the existing intake while the larger one is constructed. This estimate assumes a total downtime of six weeks to allow for transition to the new, larger intake structure. Since the new intake structure is essentially a replacement of the existing structure, O&M costs are not expected to be different than what is currently incurred by the station.

3.8 GUNDERBOOM

The Gunderboom® MLES™ (Marine Life Exclusion System) consists of a two-layer, full-depth fabric filter that is installed around the entrance to a CWIS to physically exclude organisms from entering the cooling system. The fabric curtain is typically suspended by floatation billets along the top and anchored into the substrate of the source water body. Since the surface area of the fabric curtain is much larger than a typical intake screen, water velocity through the curtain is substantially less than the velocity near the intake structure. Gunderboom aims to design MLESs with an intake velocity of approximately 7 gpm per ft^2 fabric. Sediments and passive microorganisms that inevitably become entrapped in the fabric can be removed with Gunderboom's AirBurst™ cleaning system, which routinely releases bursts of compressed air along the base of the curtain to free the entrapped materials.

There are different types of anchors available, ranging from concrete blocks to helical-types. The most appropriate type of anchoring system depends on site-specific conditions. In areas with ecologically sensitive bottom habitats, helical-type anchors are advantageous over concrete blocks since they essentially have no footprint; however, site-specific conditions such as water velocities and loading may preclude their use. Regardless of the type of anchor, the system typically consists of one anchor placed every 30 feet on both the inside and outside fabric layers.

The effectiveness of the Gunderboom system to reduce entrainment has been studied in the field at the Lovett Generating Station located on the lower Hudson River. Studies conducted in 2000, at a time when the fabric pore size was 0.5 mm, indicated the Gunderboom was approximately 80 percent effective in reducing overall entrainment (USEPA 2005). The recent entrainment monitoring study completed in 2010 (Kleinschmidt 2010) at MTS indicated that more than 99 percent of the entrainment occurs during the period of May to July. Assuming the effectiveness would be similar to that demonstrated at the Lovett site, seasonal deployment of a Gunderboom system at MTS during this three-month period could potentially reduce annual entrainment by 80 percent.

Gunderboom was contacted to provide an estimate of the size and cost of net that would be required to be protective of entrainment at the MTS CWIS. Based on a mesh size of 0.5 mm, a design intake flow of 92,000 gpm, and a water depth of 20 ft, the fabric length would need to be approximately 800 feet long. The estimated total cost is approximately $2.2M, based on a phased approach to implementation, which includes design concept, field data acquisition, final detailed engineering, fabrication/procurement, installation, and integrative commissioning. The estimated annual O&M costs range from $325,000 - $450,000, which assumes a six-month seasonal deployment and includes annual deployment and removal. Based on information from Gunderboom, the MLES base structure has a life expectancy of about seven to ten years. The fabric curtain is designed so that individual panels can be removed and replaced as necessary, but in general, the fabric has a life expectancy of three to five years.

3.9 CYLINDRICAL WEDGE WIRE SCREENS

EPA requested additional information on the expected reduction in I&E if cylindrical wedge wire screens with a slot width of 3 mm were installed at MTS as described in the Cooling Water Intake Structure Information Document (January 2008). Extensive laboratory studies of the effectiveness of 0.5, 1 and 2 mm slot widths have been conducted, as well as field investigations at actual facilities where cylindrical wedge wire screens have been installed. Upon review of the technology and available data, EPA (USEPA 2002) concluded that installation of cylindrical wedge wire screens could allow for between 80 and 90 percent reduction in entrainment.

While anticipated entrainment reductions could be hypothesized based on laboratory or previous field studies of wedge wire screen applications, a common conclusion of many of these studies is that overall effectiveness in reducing entrainment depends on site-specific factors, including the sizes of the organisms susceptible to entrainment in the water body, the velocity of the water passing the screens, the through-slot velocity, and the potential for biofouling.

Field studies were conducted in the canal of the Chalk Point Generating Station using cylindrical wedge wire screens with 1, 2, and 3-mm slot widths. (Weisberg et al. 1987). Results suggested that the effectiveness of different slot widths was influenced by the size of the larvae, such that the degree of exclusion by the screens increased with fish length. Fish less than 5 mm were not excluded by any of the screens and fish greater than 10 mm were excluded by screens of all slot widths tested (Weisberg et al. 1987). Combining the results for all fish sizes, the 3-mm slot screen was approximately 83 percent effective in reducing larval entrainment. In terms of eggs, results indicated none of the slot widths were effective in reducing egg entrainment. Applying these study results to the entrainment estimates developed for MTS, cylindrical wedge wire screens could potentially be 83 percent effective in reducing larval entrainment. However, the range of larval hatch lengths reported for some of the most abundantly entrained species at MTS are close to or below 5 mm, such as common carp (3-5.6 mm), blueback herring (3.1-5 mm), shiners (4-6 mm), sea lamprey (3-5 mm), and tessellated darter (5-6 mm).

Since previous studies have indicated that entrainment decreases with decreasing slot sizes, it is likely that further reductions would be realized through the use of cylindrical wedge wire screens with 0.5-mm slot width. Field study evaluations conducted in Chesapeake Bay with 0.5 and 1 mm wedge wire screens and through-slot velocities of 0.15 and 0.30 m/s proved that 0.5-mm slot widths were more effective at reducing entrainment under both velocity scenarios (EPRI 2006), although the reported effectiveness was not quantified.

Available sources of literature regarding the mortality of ichthyoplankton that become entrapped on wedge wire screens are limited. Studies have been conducted to evaluate the effects of shear forces on fish larvae and eggs (Morgan et al. 1976; Ekholm 2009), but these studies were based on laboratory experiments and did not account for the variability that typically occurs in nature. For example, Morgan et al. (1976) developed equations to predict the mortality of striped bass and white perch eggs and larvae due to rotation and deformation effects caused by the shear forces of moving water. While this paper provided information regarding the effects of water velocities on the survivability of these species of eggs and larvae, it did not take in account the potential effects due to contact with objects, such as debris or screening devices. Ekholm (2009) subsequently used the equations developed by Morgan et al. to evaluate the effects of the duration of contact with wedge wire screens on mortality rates of the two species, as well as the effects of velocity that are typical for the Johnson wedge wire screens. Ekholm reported that the velocity used as design guides for wedge wire screens (0.5 fps maximum) does have a minimal effect on fish eggs and larvae. Striped bass eggs were most sensitive to the effect of shear forces due to velocity, such that a velocity of 0.5 fps resulted in a mortality rate of 5 percent. It was also determined that the duration of contact with the screen had a profound effect on the mortality rate; however, the current velocity surrounding the screen must also be considered. For example, Ekholm determined that with a current velocity of one fps, the mortality rate for striped bass eggs held against the screen for one minute was approximately 14 percent. The mortality rate nearly doubled (25.4 percent) when the duration of contact was increased to four minutes. Neither of these studies examined the potential effects debris in the water body or on the screens. Contact with debris in the water body or smothering by debris on the screens would increase mortality rates, but to what extent remains unknown.

In order to accommodate the 133.2 MGD design intake flow for MTS operations, a total of six, 7-foot diameter wedge wire screens (0.5 mm slot width) would be needed with a maximum through-slot velocity of 0.5 fps. Each screen would be about 25 ft in length and require a 14-ft depth of water at the point of installation (1/2-diameter clearance on all sides). Since the depth of the Connecticut River in front of the CWIS entrance is approximately 15 ft at mean low water, the screens would need to be installed further offshore to deeper areas to ensure submersion during extreme low flow periods.

The estimated capital cost for this option utilizing 0.5-mm mesh cylindrical wedge wire screens as established in the EPA's Technical Development Document and adjusted for site-specific conditions at MTS is approximately $9 million. These costs are based on 304 stainless steel wedge wire T-screens (for freshwater environments), a connecting sheet pile wall in front of the intake (acting as a common plenum), pre-stressed concrete cylinder underwater piping and new airburst screen cleaning systems. Capital costs will increase if a pre-engineered structure is needed to house the new air-burst system equipment on shore. EPA estimates that a unit downtime for implementation of wedge wire could be approximately 13 weeks or less if construction coincides with a scheduled maintenance outage.

The majority of the O&M costs is associated with the air burst system, but also includes one underwater inspection by divers per year. It is estimated that the annual O&M cost for 0.5-mm cylindrical wedge wire screens at MTS is approximately $40,000. These O&M costs include periodic cleaning and inspection, O&M for the air burst system, and power costs for operation of the air compressors.

Impacts associated with installation of 0.5-mm cylindrical wedge wire screens would be similar to those previously described in the 2008 MTS Cooling Water Intake Structure Information

Document. It is expected that impacts to benthic habitat would be increased since the 0.5 mm option requires twice as many screens (six, 0.5-mm screens as opposed to three, 3-mm screens), so footprints of three additional screens would permanently remove a proportional area of habitat.

3.10 EXPANDED INTAKE

Yearly O&M costs associated with expanding the intake at the river at MTS are not expected to be different than the O&M costs currently incurred by MTS for the existing intake structure.

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APPENDIX A
CORRESPONDENCE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
5 POST OFFICE SQUARE - SUITE 100
BOSTON, MASSACHUSETTS 02109-3012

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

February 15, 2011

Michael Gwyther, Station Superintendent
First Light Power Resources
Mount Tom Station
200 North Hampton Street
Holyoke, MA 01040

Re: Information Request for NPDES Permit Reissuance, NPDES Permit No: MA0005339

Dear Mr. Murray:

The New England Regional Office of the United States Environmental Protection Agency (EPA or Agency) is developing a draft National Pollutant Discharge Elimination System (NPDES) Permit (No. MA0005339) for FirstLight Power Resources Services, LLC's (FirstLight or the Company) Mount Tom Electric Generating Station, Holyoke, MA (MTS or Station).

In support of this work, EPA is sending FirstLight this information request letter pursuant to Section 308(a) of the Clean Water Act (CWA), 33 U.S.C. §1318(a). CWA § 308(a) provides, in pertinent part, as follows:

> [w]henever required to carry out the objective of this chapter, including but not limited to (1) developing or assisting in the development of any effluent limitation, or other limitation, prohibition, or effluent standard, pretreatment standard, or standard of performance under this chapter; . . . (3) any requirement established under this section; or (4) carrying out section[ ] . . . 1342 . . . of this title –
>
> (A) the Administrator shall require the owner or operating of any point source to . . . (ii) make such reports, . . . and (v) provide such other information as he may reasonably require . . ..33 U.S.C. § 1318(a). Failure to comply with an EPA information request sent under CWA § 308(a) could subject the recipient of the request to an EPA enforcement action under CWA § 309, 33 U.S.C. § 1319.

FirstLight may assert a business confidentiality claim with respect to part or all of the information submitted to EPA in the manner described at 40 CFR Part 2.203(b). Information covered by such a claim will be disclosed by EPA only to the extent, and by means, of the procedures set forth in 40 CFR Part 2, Subpart B. If no such claim accompanies the information when it is submitted to EPA, it may be made available to the public by EPA without further notice to FirstLight. Please note that effluent information may not be regarded as confidential.

Information Request

I. Thermal Discharge Information Request

a. As part of the MTS NPDES Permit File, EPA retains a copy of a thermal plume study of the MTS discharge from Outfall 001, conducted in June and August of 1974. Please submit to EPA any additional thermal studies in your possession pertaining to the Connecticut River in the general area of MTS, including any thermal discharge modeling or in-stream thermal monitoring conducted by or for MTS.

b. Conduct a thermal plume analysis of Outfall 001 and submit to EPA the detailed impact of the thermal discharge on the Connecticut River under the following projected conditions:

1) a MTS discharge with a delta T of 20°F and a discharge temperature of 102°F during one pump operation (70 million gallons per day (MGD)) as well as two pump operation (133.2 MGD). These operational conditions shall take place during a warm weather summer period (air temperature 95°F) accompanied by low flow conditions in the Connecticut River (approximately 3000 cfs).
2) a MTS discharge with a delta T of 20°F and a discharge temperature of 80°F during one pump operation (70 million gallons per day MGD) as well as two pump operation (133.2 MGD). These operational conditions shall take place during representative spring (April – May) conditions (air temperature 65°F) accompanied by spring flow conditions in the Connecticut River (approximately 15,000 cfs).
3) a MTS discharge with a delta T of 32°F and a discharge temperature of 115°F during one pump operation (70 MGD). These operational conditions shall take place during a warm weather summer period (air temperature 95°F) accompanied by low flow conditions in the Connecticut River (approximately 3000 cfs). See Sections 5.4, Attachment I.
4) a MTS discharge with a delta T of 32°F and a discharge temperature of 115°F during one pump operation (70 MGD). These operational conditions shall take place during representative spring (April – May) conditions (air temperature 65°F) accompanied by spring flow conditions in the Connecticut River (approximately 15,000 cfs). See Section 5.5, Attachment I.

Include an explanation of methods used to conduct this analysis.

c. The information requested in Parts I.b.1) and I.b.2) shall be represented as a series of maps, showing the positions of isotherms at two degree Fahrenheit intervals in the river, represented as 1) the difference in temperature between the temperature affected by the discharge and the ambient river temperature in degrees Fahrenheit (delta T), and 2) the absolute temperature in degrees Fahrenheit. The maps shall display the area of the river from just upstream of the outfall to the downstream point in the river where fully mixed ambient river conditions resume. The distance represented by the maps shall be clearly identified.

1) One series of maps shall represent an overhead view of the river, showing bank-to-bank or lateral isotherms at the surface, at mid-depth and near the bottom of the river.

2) Another series of maps shall represent a longitudinal profile, showing temperatures at all depths along the longitudinal line of maximum temperatures, with isotherms.

Include an explanation of methods used to construct these maps. A series of monthly progress reports shall be submitted to EPA, as specified in Part III.b. of this letter. The first progress report shall identify the additional environmental data necessary to select, calibrate and verify a satisfactory model which is capable of generating the data requested in Parts I.b. and I.c. A schedule detailing the timeline to complete Parts I.b and I.c. shall also be included in the first progress report.

d. As part of the CWIS technology evaluation, EPA requests that FirstLight submit an overview of MTS's potential impacts to the aquatic habitat of the Connecticut River under current operating conditions, as well as projected operation using the technologies being evaluated. Particular attention must be paid to impacts to all life stages of shortnose sturgeon (Federally Listed Species), Atlantic salmon (Essential Fish Habitat), and river herring and American shad (anadromous species). Evaluate the expected impacts to aquatic life in the Connecticut River when any construction or benthic disturbance in the river is part of the installation and/or operation of a technology discussed in Attachment I.

II. Impingement and Entrainment Reduction Best Technology Available Information Request

EPA has reviewed the MTS Impingement Report (December 2008), the MTS Cooling Water Intake Structure Information Document (January 2008), and raw entrainment data from MTS from October 2008 through September 2009, submitted on May 11, 2010.

The documents identified above were used to examine the feasibility of technologies necessary to achieve the best technology available (BTA) for minimizing adverse environmental impacts from impingement and entrainment at MTS.

Please provide the following information:

a. Review EPA's Preliminary 316(b) Technology Feasibility Review (Attachment I) and update, supplement and/or correct the information to the extent that it is outdated, incomplete or inaccurate.

b. Provide detailed costs as annual costs and as net present value costs (NPV) for cost estimates listed in the MTS Cooling Water Intake Structure Information Document (January 2008) and identified in Attachment I. It was not clear to EPA whether costs were presented as NPV in the January 2008 document. If a cost is not provided for a technology in this document and it is requested in Attachment I, please submit cost information or an explanation as to why a cost cannot be determined. NPV costs shall be annualized over the expected life of the technology. Assume a discount rate of 7.6% or explain the basis of an alternate discount rate. If a different method is used to represent the cost of the technology, all appropriate technologies evaluated in the January 2008 report and identified in Attachment I must be recalculated using the different method so that the annualized NPV cost estimates for each technology are directly comparable. A justification for the selected cost calculation must also be included.

c. Provide information on the extent to which the MassDEP consent order to cap and clear cut the northern sector of the Mount Tom site may affect the placement of a Mechanical Draft Cooling Tower(s).

d. Provide information regarding the volume of discharge water expected and the specific thermal and chemical characteristics of the discharge each month using a Mechanical Draft Cooling Tower(s) closed cycle cooling system at Mount Tom Station (Section 5.1, Attachment I). Include the dimensions and thermal characteristics of the reduced thermal plume in the Connecticut River each month.

e. Provide a yearly cost estimate, if any, related to maintaining one pump operation in May and June while still meeting delta T and maximum temperature discharge limits now in effect. Also provide a yearly cost estimate assuming one pump operation in May and June with a delta T limit of 32°F and the maximum discharge temperature limit of 115°F Also assess the impact of increased water temperature from the MTS discharge during the warmer months (see Section 5.5, Attachment I).

f. Determine the percentage of excess capacity of the cooling water intake pumps at MTS for each month and assess the potential for reduction in cooling water use and related reduction in impingement and entrainment. Provide a yearly operational cost resulting from the use of variable speed pumps. (Section 5.6, Attachment I).

g. Provide a complete estimate of capital cost and yearly operational and maintenance costs to upgrade the fish return system at MTS, including modifications to the intake structure to accommodate the larger screens (Sections 5.7 and 5.8, Attachment I).

h. Evaluate the expected performance of the Barrier Net at a pore size designed to eliminate or substantially reduce entrainment in the Connecticut River and provide the expected area of the net, location and anchoring needed for barrier nets of this pore sizes. Also include all costs (Section 5.9, Attachment I).

i. Evaluate the reduction in entrainment of Connecticut River ichthyoplankton by using cylindrical wedge wire screen intakes with a mesh size of 3 millimeters. Discuss mortality estimates of ichthyoplankton that become trapped on the wedge wire screen. Evaluate the cylindrical wedge wire screen impingement and entrainment effectiveness with slot sizes of 1.0 mm and 0.5 mm. Determine the size and number of cylinders necessary to be able to use cylindrical screens of these slot sizes and evaluate the feasibility of installing and operating these units as well as the impacts associated with their placement and operation. Also include all costs (Section 5.11, Attachment I).

j. Provide yearly operation and maintenance costs associated with expanding the intake at the river at MTS (Section 5.12, Attachment I).

III. Deliverable Schedule

a. Submit the document(s) requested in Part I.a. of this letter, if any, within 30 days of the receipt of this letter.

b. Submit a monthly progress report during the last week of each calendar month, detailing the progress of the thermal analysis requested in Parts I.b. and I.c. of this letter.

c. Submit all information requested in Parts I.b., I.c. and I.d. within 90 days of the receipt of this letter.

d. Submit the information requested in Part II. of this letter within 45 days of receipt of this letter.

Contact John Nagle of my staff (617) 918-1054 if you have questions regarding this request. The EPA looks forward to working with you on your new permit.

Sincerely,

KM for

Stephen S. Perkins, Director
Office of Ecosystem Protection

cc: Gerry Szal, MassDEP
David Webster, EPA
Julie Crocker, NMFS Protected Resources Division

Attachment I
Preliminary 316(b) Technology Feasibility Review
Mount Tom Station

The information included in this attachment, unless otherwise noted, was taken from the Mount Tom Station (MTS) Cooling Water Intake Structure (CWIS) Information Document, submitted to EPA on behalf of FirstLight Power Resources, LLC, in January of 2008 (MTS Report; 2008 Report). EPA is using the information included in the 2008 document to further the analysis and screening necessary to determine the best site-specific technology available to minimize the adverse environmental impacts from a CWIS at MTS. The inclusion of estimated performance and cost information from FirstLight in this attachment does not signify that EPA concurs with the information included in the 2008 report. In some cases, when no cost information was provided by MTS, EPA has inserted cost information to allow for comparison among technologies. EPA reserves the option to revise, amend or delete information included in this attachment as updated analyses and estimates are conducted.

1.0 Overview of Current MTS CWIS Characteristics

The intake structure at MTS consists of an 8.0 foot diameter pipe. The pipe opening at the river contains a series of parallel metal bars, with an 8.5 inch space between each bar. The bars are configured to prevent large objects from being pulled into the intake structure pipe. This structure extends approximately 30 feet into the river from shore, near the bottom, on an inside curve of Connecticut River mainstem.

From November through April, the permit limits the intake of water to one operating pump, with a flow limit of 68.4 MGD (47,500 gpm). This results in a "through screen" velocity at the bar screen of 2.1 fps.

From May through October, the permit limits the intake of water to two operating pumps, with a flow limit of 133.2 MGD (92,500 gpm). This results in a "through screen" velocity at the bar screen of 4.1 fps.

According to MTS Discharge Monitoring Reports from the year 2000 through 2004, the average water flow was 85.4 MGD.

An interior structure also makes up part of the CWIS. This interior structure is approximately 350 feet away from the river bank, with a "through screen" velocity of 1.6 fps at two 3/8 inch square traveling screen bays, each 10 feet wide by 13 feet deep.

The screen wash and return gutter system that removes debris from the screens also transports fish off the traveling screens. The screen wash pump water is taken from the facility discharge. Because the discharge water contains waste heat, this spray wash water has a temperature increase (delta T) of up to 32^{0}F from ambient water in the river. The system washes off the traveling screens with 70 pounds per square inch (psi) water pressure. Fish are subjected to a large vertical free-fall from the end of the screen wash trough into a culvert, where a 300 foot half-pipe conveys the fish to the river. The half-pipe design of this part of the fish/debris return system exposes fish to adverse weather conditions. In addition, predators in the vicinity of the half-pipe are able to intercept fish during this last part of their transport back to the river.

An electric fish barrier has been in operation since facility start-up (1960) to reduce impingement. This barrier is located in front of the river intake of the CWIS. An MTS study conducted at EPA's request in 2007 concluded that "the electric barrier is not effective at deterring fish from entering the intake."

2.0 Impingement

An Impingement Study was conducted by Kleinschmidt on behalf of MTS from July 2006 through July 2008. A summary of the results is presented below:

- 85 fish impinged in first year
- 250 fish impinged in second year
- Based on continuous facility withdrawal
  - 572 fish estimated impinged in first year
  - 1,695 fish estimated impinged in second year
- Average yearly impingement estimate of 1,133 fish

Impingement was recorded in all months, with relatively high fish impingement numbers in December and March through April.

The species impinged included yellow perch, white sucker, spottail shiner, bluegill, gizzard shad, common shiner, Atlantic salmon. Impinged fish were predominantly, but not exclusively, resident species.

MTS estimated the overall impingement survival rate to be between 4 and 17%, depending on season. The study did not include the 300 foot transport to river in the evaluation.

3.0 Entrainment

A two year entrainment study was conducted from October 2008 through September 2010. MTS submitted the results of the study to EPA in November of 2010 (Mount Tom Generating Station Ichthyoplankton Data Report). According to MTS, a relatively small number of fish eggs were entrained in both years. Larvae were collected only in April through August of 2009 and May through July of 2010. Peak larval totals occurred in June. Common carp, herring and shiners made up the majority of the larvae collected. The volume of cooling water withdrawn during the spawning season was closely related to the number of larvae entrained. Based on monthly larval entrainment levels submitted by MTS, EPA estimated the number of larvae that would be entrained if the facility withdrew the maximum permitted rate in May, June and July. EPA estimated a value of approximately 6.8 million larvae in 2009 and approximately 16.6 million larvae in 2010, with an average of 11.7 million entrained larvae over the two years. In the absence of a site-specific study to investigate the potential survival of entrained ichthyoplankton at MTS, an entrainment mortality rate of 100% is assumed.

4.0 River / Withdrawal / Discharge Stats

Information presented in this section was calculated from MTS's NPDES permitted limits and the United States Geological Survey Connecticut River data. MTS withdraws approximately 1.4 % of the Connecticut River annual mean flow (9,264 MGD) and approximately 11.6% of the Connecticut River 7Q10 flow (1,147.2 MGD).

From November through April, the permit limits the intake of water to one operating pump, with a maximum flow limit of 68.4 MGD (47,500 gpm). The maximum discharge temperature limit for this time period is 102^{0}F and the maximum delta T limit is 32^{0}F

From May through October, the permit limits the intake of water to two operating pumps, with a maximum flow limit of 133.2 MGD (92,500 gpm). The maximum discharge temperature limit for this time period is 102^{0}F and the maximum delta T limit is 20^{0}F

As a way to assess the relative amount of water typically withdrawn by MTS, the following information was assembled, based on a five year average of the Connecticut River discharge:

CT River Discharge	time span	% of CT River withdrawn by MTS
30,000 cfs (19,389 MGD)	April, May	- 0.4 – 0.7% withdrawn by MTS
20,000 cfs (12,926 MGD)	Nov, Dec, Jan	- 0.5% withdrawn by MTS
15,000 cfs (9,695 MGD)	June	- 1.4% withdrawn by MTS
9,000 cfs (5,817 MGD)	Feb, March	- 1.2% withdrawn by MTS
7,000 cfs (4,524 MGD)	October	- 2.9% withdrawn by MTS
5,000 cfs (3,232 MGD)	July, Aug	- 4.1% withdrawn by MTS
3,000 cfs (1,939MGD)	September	- 6.9% withdrawn by MTS

5.0 Technology Evaluation

The following technologies have been evaluated by MTS to determine the degree to which they would be expected to minimize fish impingement and entrainment mortality at Mount Tom Station. MTS also provided the estimated site-specific cost of each technology, unless otherwise noted that EPA estimated the cost.

5.1 Mechanical Draft Cooling Towers (MDCT)

MDCT are expected to reduce the volume of non-contact cooling water needed by approximately 97%. The "through screen" velocity of the cooling water at the bar screen at the river would be reduced to approximately 0.11 fps. The reduction in cooling water would likely result in a corresponding percent decrease in fish impingement and entrainment mortality of approximately 97%. The thermal plume would also be reduced by a large percentage. The estimated percentage reduction was not included in the analysis.

The cost estimates for converting to MDCT at MTS are as follows:

- \$58.4 million capital cost;
- \$ 4.0 million lost generation during construction;
- \$ 5.3 million annual operation and maintenance cost.

5.2 Natural Draft Cooling Towers (NDCT)

NDCTs are generally designed for facilities using non-contact cooling water at a rate of 200,000 gpm or greater. Since MTS uses less cooling water than this threshold (92,500 gpm), NDCTs are considered oversized in this site-specific case.

According to MTS, NDCTs of this size would increase O&M costs several times over MDCTs at their facility. In addition, MTS reports that the overall cost of NDCTs are expected to be higher than MDCTs, in this site-specific case. No cost estimates are included as part of the analysis. Based on the information that NDCTs are more costly than MDCTs and equally effective, EPA is not seeking this cost information as of the writing of this preliminary review.

5.3 Use of Grey Water

The Holyoke Water Pollution Control Facility (HWPCF) discharges up to 17 MGD and is 8.3 miles downstream of MTS. In theory, this facility could provide approximately 13% of the flow currently removed from the river by MTS from May through October and approximately 25% from November through April. EPA estimates that using water from the HWPCF could reduce the "through screen" velocity at the bar screen intake at the river intake point to 1.5 fps (November-April) and 3.5 fps (May – October).

While the MTS CWIS at the river would still have an approach velocity above 0.5 fps, EPA estimates that the use of grey water would likely reduce impingement by approximately 13% from May through October and approximately 25% from November through April. Also, EPA assumes that a likely reduction in entrainment of approximately 13% could be expected from May through October. The low entrainment rate projected from November through April would likely be unaffected.

One challenge facing this technology is the logistic difficulty related to the construction of a water transport pipe to connect the facilities. Also, the discharge of grey water at 102^{0}F could increase the potential for additional primary productivity in the river in the vicinity of the MTS discharge.

No cost information is provided for the construction and operation of this technology. EPA is not seeking this cost information as of the writing of this preliminary review.

5.4 Year Round Flow Reduction

The objective of this option is to reduce the amount of cooling water used at MTS by remaining at one pump operation (68.4 MGD) all year. This would result in a 47 % reduction in flow during the May through October time period. It is projected to reduce impingement and entrainment by approximately 47%.

The "through screen" intake velocity at the metal bars at the river would remain approximately 2.1 fps. This velocity is well above 0.5 fps, which is considered by EPA to be a component of BTA in most cases. Assuming that the overall heat content of the thermal discharge does not change greatly from historical levels, the permitted delta T limit during the May through October time period would increase from 20^{0}F to 32^{0}F. Also, the maximum discharge temperature limit would increase from 102^{0}F to 115^{0}F for the months of May through October. The impact of the increased water temperature to the river (although with a reduced flow) during the warmer months has not been evaluated by the permittee.

According to the MTS 2008 Report, following the one pump operating conditions outlined above, plant output would be reduced by 21% during the months of June and September and approximately 37% during the months of July and August. This drop in production would cost the plant approximately $4 million per year in lost revenue.

5.5 May and June Flow Reduction

EPA has included this option for discussion. The objective of this option is similar to the option presented in Section 5.4, with the exception that one pump operation (68.4 MGD) is extended for the additional months of May and June only. According to the USGS Connecticut River 5 year flow average, July is expected to be a lower flow month, compared with May and June. EPA is concerned that increasing the delta T limit and maximum discharge temperature in July may have a larger impact on aquatic life in the river under expected lower flow conditions. As noted in Section 5.4, the impact of the increased water temperature to the river during July has not been evaluated by the permittee.

This modification may reduce entrainment by approximately 42%, as May and June are large entrainment months. Impingement, however, would only be reduced by approximately 1.6 - 5.7%

The lowest "through screen" intake velocity at the river would still be approximately 2.1 fps, well above 0.5 fps. The permitted delta T would increase to 32^{0}F and the maximum discharge temperature would increase to 115^{0}F for the months of May and June. The impact of the increased temperature to the river during these two additional months has not been evaluated by the permittee.

The estimated operational cost of this option is $2 million per year in lost revenue. NOTE: This cost is estimated by EPA and must be verified by MTS.

5.6 Variable Speed Pump

According to MTS, the installation and use of variable speed pumps to control the rate of cooling water used at the facility will reduce the approach velocity of the CWIS and thus reduce impingement. In order for this to be an effective operational measure, the facility must have excess pump capacity. The percentage of excess pump capacity at MTS for each month must be determined.

The estimated capital cost of this technology is $800,000. Yearly operational costs are not included.

5.7 Fish Return System Upgrade

There are many site-specific issues that must be taken into consideration when designing and operating a fish return system (FRS) that minimizes adverse impacts to fish. Some basic components of an FRS that satisfy BTA generally include 1) a travelling screen designed to minimize stress to impinged fish; 2) a low-pressure, ambient temperature spray wash system that dislodges fish from the traveling screen with a minimum of damage; 3) a sluiceway with no sharp angles or protrusions that may damage fish tissue; 4) a mechanism to reduce or eliminate predator access to the return system; and 5) a design that does not allow the fish to free-fall great distances into the shallow water at certain tides or river levels. In order to upgrade the current fish return system at MTS to satisfy BTA, the temperature of spray wash water must be ambient temperature. As discussed in Section 1.0 of this document, the screen wash pump water is taken from the facility discharge. Because the discharge water contains waste heat, this spray wash water has up to a 32^0F delta T from ambient water in the river. Also, the sluiceway must be covered and modified to reduce predation and improve fish transport to the river. This will increase the potential for survival of fish that are impinged.

While this modification would not directly decrease fish impingement, it may reduce impingement mortality by 40%. This technology would provide no reduction in direct impingement and entrainment.

No cost information is provided for this upgrade. However, MTS includes the cost of the fish return upgrades in the Traveling Screen Upgrade, Section 5.8.

5.8 Traveling Screen Upgrade

In addition to the improved sluiceway described in Section 5.7, Ristroph traveling screens are also evaluated at the MTS CWIS. This technology provides no reduction in direct impingement and entrainment. However, along with upgrades to the fish return system detailed in Section 5.7, MTS estimates reductions in impingement mortality of approximately 40%.

MTS estimates the capital cost of this technology is $2 million. This cost includes the Ristroph traveling screens, additional spray water and a 500 foot long fish sluiceway. Operation and maintenance costs are estimated at $144,000.

5.9 Barrier Net

MTS evaluated a barrier net approximately 172 feet long and 20 feet deep, with a 3/8 inch mesh pore size (9.5 millimeter). A net of these dimensions and pore size would result in a through-net velocity of 0.06 fps. Installation of this technology involves construction and benthic disturbance in the Connecticut River in front of the CWIS.

MTS estimates a reduction in impingement of 100%, but at the pore size indicated, no reduction in entrainment is expected.

MTS estimates the capital cost to be $45,000 and the operation and maintenance cost to be $101,000 per year.

5.10 Electric Fish Barrier

Based on the information submitted by MTS as part of their December 2008 Impingement Report, the electric fish barrier is not effective at reducing impingement or entrainment. EPA is not seeking further information regarding this technology as of the writing of this preliminary review.

5.11 Cylindrical Wedge Wire Screens

This technology involves the installation of three cylindrical screens in the river in front of the MTS CWIS. Each screen would be 6 feet in diameter and 20 feet long. The screen openings would be 3 millimeters. Installation of this technology involves construction and benthic disturbance in the Connecticut River in front of the CWIS.

MTS estimates that the wedge wire screens as described here will reduce impingement by 100%. The permittee did not specify the reduction in entrainment of Connecticut River ichthyoplankton by using wedge wire screens with a mesh size of 3 millimeters or the associated mortality of ichthyoplankton encountering the wedge wire screen, but EPA assumes this mesh size to be largely ineffective in reducing entrainment in this case.

There is the potential for river debris to clog the surface of the wedge wire screen cylinders. This may increase operation and maintenance costs.

The costs associated with the 3 millimeter wedge wire screen cylinders are estimated by MTS as follows:

- $ 7 million capital cost
- $ 2 million lost generation during construction
- $ 32,000 operation and maintenance cost per year

5.12 Expanded Intake At River

This technology is based on increasing the overall opening of the CWIS at the river. Provided the same volume of water is being withdrawn, a larger opening will result in a reduced "through-screen" velocity at the river. The opening will be sized to result in a through-screen velocity of 0.5 fps.

No barrier is included to prevent fish from entering the large intake openings in the river. Without a physical barrier, this technology will still allow fish to enter into the intake pipe and become impinged on the rotating screens at the end of the pipe. Ristroph screens and an improved fish return system (see Sections 5.7 and 5.8) are included as part of this technology to reduce impingement mortality when this occurs. Installation of this technology involves construction and benthic disturbance in the Connecticut River in front of the CWIS.

MTS estimates that this technology will reduce impingement by 80% and reduce impingement mortality by 40%.

This technology will have no measurable impact on losses due to ichthyoplankton entrainment.

A capital cost of $6 million is estimated by MTS to expand the intake at the station. An additional $6 million in lost generation during construction is projected. No operation and maintenance costs are included.

5.13 CWIS Relocation

Kynard et al (2003) predicted that greater numbers of fish will likely be impinged if the CWIS at MTS is moved further away from the river bank and closer to the channel. The MTS CWIS is currently located at a bend in the river, far from the main channel. Relocation of the CWIS, while maintaining the present design, capacity and construction features, is not considered an effective technology to reduce impingement or entrainment. EPA is not seeking additional information regarding CWIS relocation as of the writing of this preliminary review.

6.0 Technology Analysis and Comparison

Based on the preliminary information presented in Section 5 of this document, natural draft cooling towers, the use of grey water, variable speed pumps, electric fish barrier, and CWIS relocation have been set aside and are not included for further BTA analysis as of the writing of this review.

The remaining technologies are compared in the tables and graphs below.

EPA has estimated the annual cost based on capital costs and operational and maintenance costs provided by MTS in the Cooling Water Intake Structure Information

Document (January 2008), unless otherwise noted. EPA estimated the life of the various technologies and assumed the discount rate. These costs, estimates and assumptions must be verified by MTS.

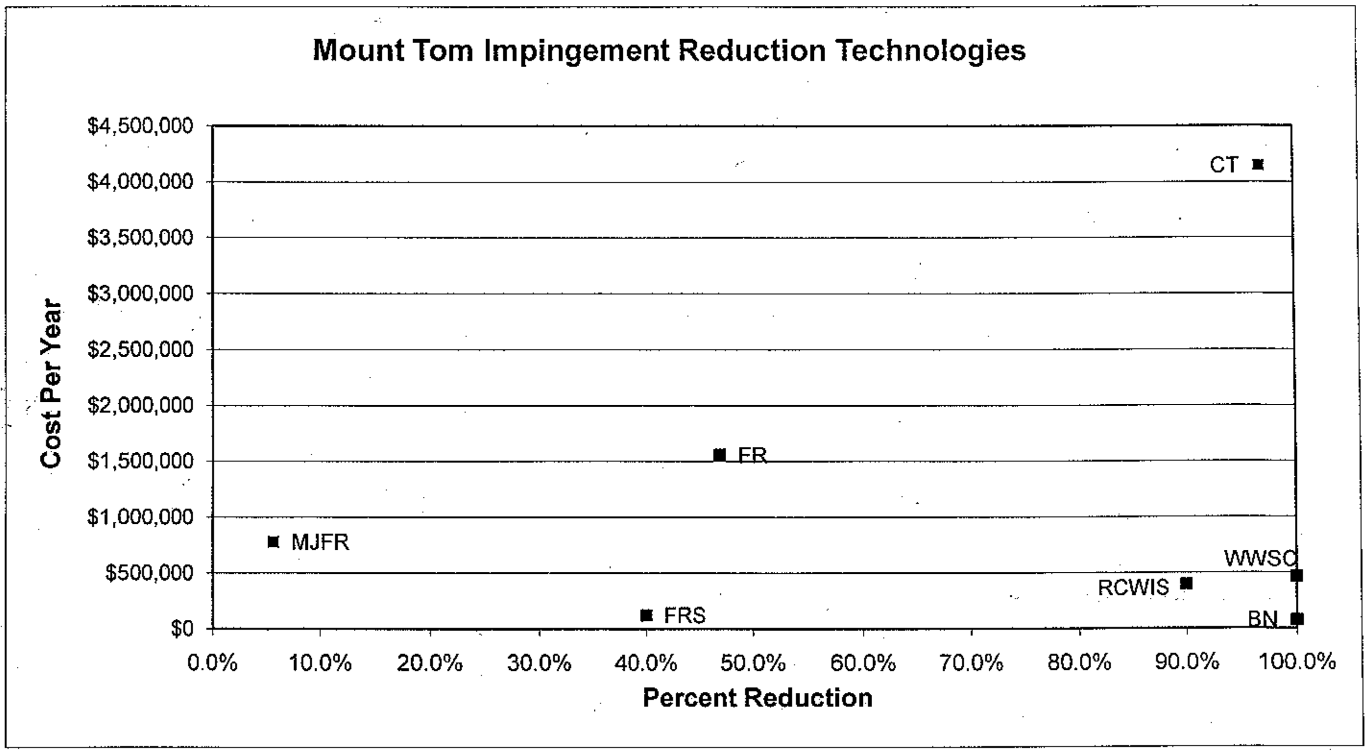
	Mount Tom Station Impingement Technologies				
	additional cost per year	yearly fish impingement mortality	impingement mortality reduction	additional # of fish survive per year	# of fish die per year
Current Operation/Technology	$0	1,133	0.0%	0	1,133
Mechanical Draft Cooling Towers	$4,146,351	------	97.0%	1,099	34
Year Round Flow Reduction	$1,559,510	------	47.0%	533	600
May and June Flow Reduction	$779,755	------	5.7%	65	1,068
Fish Return System Upgrade	$122,809	------	40.0%	453	680
Barrier Net	$76,285	------	100.0%	1,133	0
Wedgewire Screen Cylinders	$466,188	------	100.0%	1,133	0
Expanded River CWIS	$400,000	------	90.0%	1,020	113

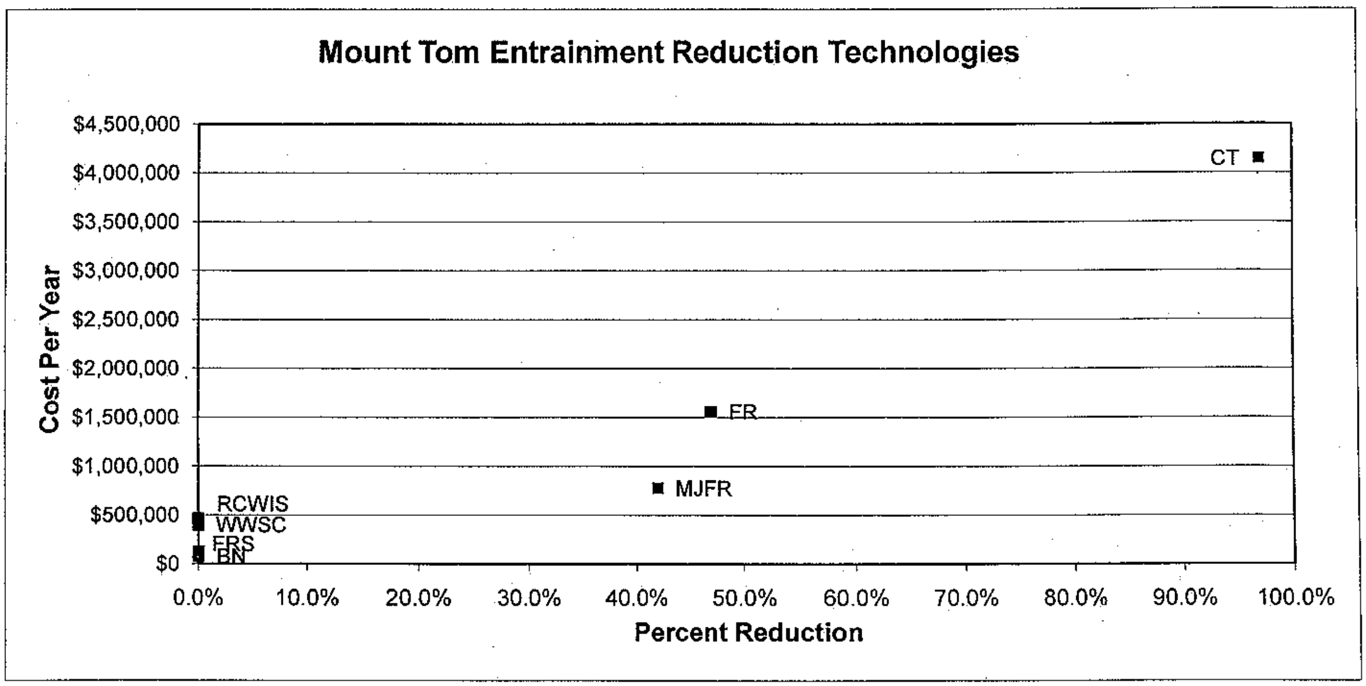
	Mount Tom Station Entrainment Technologies				
	cost per year	yearly larval entrainment	entrainment reduction	larval survival per year	larval mortality per year
Current Operation/Technology	$0	11,693,000	0.0%	0	11,693,000
Mechanical Draft Cooling Towers	$4,146,351	-----------	97.0%	11,342,210	350,790
Year Round Flow Reduction	$1,559,510	-----------	47.0%	5,495,710	6,197,290
May and June Flow Reduction	$779,755	-----------	42.0%	4,911,060	6,781,940
Fish Return System Upgrade	$122,809	-----------	0.0%	0	11,693,000
Barrier Net	$76,285	-----------	0.0%	0	11,693,000
Wedgewire Screen Cylinders	$466,188	-----------	0.0%	0	11,693,000
Expanded River CWIS	$400,000	-----------	0.0%	0	11,693,000

Costs include capital and operation/maintenance costs annualized over 30-year life of the cooling towers, flow reduction, and expanded river intake structure. Assumes a discount rate of *7.6%* pre-tax nominal value.

Costs include capital and operation/maintenance costs annualized over 20-year life of the cylindrical wedgewire screen intakes. Assumes a discount rate of *7.6%* pre-tax nominal value.

Costs include capital and operation/maintenance costs annualized over a 9 year life of the barrier nets (net and two spares). Assumes a discount rate of *7.6%* pre-tax nominal value.





CT	Mechanical Draft Cooling Towers
FR	Year round flow reduction
MJFR	May and June flow reduction
FRS	Fish return system upgrade
BN	Barrier Net
WWSC	Wedgewire screen cylinders
RCWIS	Expanded River CWIS

FirstLight
Power Resources
GDF SUEZ

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March 8, 2011

VIA FEDERAL EXPRESS

Mr. John Nagle
Office of Ecosystem Protection
U.S. Environmental Protection Agency, Region 1
5 Post Office Square-Suite 100
Boston, Massachusetts 02109-3012

<u>Request for Minor Modifications to the Information Request for Mount Tom Station NPDES Permit Reissuance, NPDES Permit No.: MA0005339, Re Letter dated February 15, 2011</u>

Dear Mr. Nagle:

In response to your Information Request for Mount Tom Station NPDES Permit Reissuance, NPDES Permit No.: MA0005339, Re Letter dated February 15, 2011 and our conference call discussion on March 2, 2011, we request minor modifications which are described below.

As discussed, we propose modifications to the condition outlined in your February 15, 2011 letter listed under Section I (b) to allow for alignment with the plant heat transfer design capabilities of the Mount Tom Station. The heat transfer rate from the plant to the cooling water systems will be modeled as 6.3×10^8 BTU's/hr which was the calculated heat transfer rate for the 02/24/11 capacity audit at 159 MW gross. Thus, we propose the following conditions to be modeled in lieu of those described.

1. MTS discharge with a delta T of 26°F and a discharge temperature of 109°F during one pump operation using one circulating water pump and one river water pump (70 million gallons per day (MGD). These operational conditions shall take place during warm

weather summer period (air temperature 95°F) accompanied by low flow conditions in the Connecticut River (approximately 3,000 cfs).

2. MTS discharge with a delta T of 26°F and a discharge temperature of 103°F during one pump operation using one circulating water pump and one river water pump (70 MGD). These operational conditions shall take place during representative spring (April-May) conditions (air temperature 65°F) accompanied by spring flow conditions in the Connecticut River (approximately 15,000 cfs).

3. MTS discharge with a delta T of 13°F and a discharge temperature of 96°F during two pump operation using two circulating water pumps and two river water pumps (140 MGD). These operational conditions shall take place during warm weather summer period (air temperature 95°F) accompanied by low flow conditions in the Connecticut River (approximately 3,000 cfs).

4. MTS discharge with a delta T of 13°F and a discharge temperature of 90°F during two pump operation using two circulating water pumps and two river water pumps (140 MGD). These operational conditions shall take place during representative spring (April-May) conditions (air temperature 65°F) accompanied by spring flow conditions in the Connecticut River (approximately 15,000 cfs).

Furthermore, Section II (d) requests that the dimensions, thermal and chemical characteristics of the thermal discharge using a Mechanical Draft Cooling Tower be provided for each month. As discussed, we request that the frequency be changed from monthly to one winter and one summer condition as these two conditions are expected to represent worse-case scenarios and all the other conditions will fall between these extremes.

Section II (h) and (i) requests that evaluation of the performance of cylindrical wedge wire screen with slot sizes of 3 mm, 1 mm and 0.5 mm and a barrier net at a pore size to eliminate or substantially reduce entrainment. To determine the pore size needed to reduce entrainment, we examined larval length, as well as head diameter and width for the most abundant larval species collected at Mount Tom Station, which included yellow perch, white perch, common carp, American shad, herring, and shiners. Based on the average head dimensions of these larvae, a pore size of 0.5 mm would be needed to substantially reduce entrainment. With this information, we request that the cylindrical wedge wire screen evaluation be limited to one scenario with a slot size of 0.5 mm. In order to satisfy the request of Section II (h), we will investigate the use of *Gunderboom* to eliminate or substantially reduce entrainment at Mount Tom Station.

We understand that monthly progress reports were requested for the thermal plume modeling to keep EPA informed as additional field information was collected for the modeling. Since no additional field sampling is needed to complete the modeling and we anticipate having the modeling results provided to you within 90 days, we request you waive the request for monthly progress reports. In Section (I, a), you requested that Mount Tom submit any additional thermal plume studies other than the June/August 1974 study within 30 days. As discussed, we are not aware of any additional thermal studies that have been conducted in the Connecticut River in the general area of our station.

Finally, we request an extension from 45 days to 90 days to provide you the information requested in Section II, *Impingement and Entrainment Reduction Best Technology Available Information Request*, of the letter.

Should you have any questions, please call me at 413.536.9562

Sincerely,

Michael Gwyther
Station Manager

cc:

Gerald Szal, MA DEP
Richard Merchant FirstLight Power Resources
Chris Tomichek, Kleinschmidt Associates

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
5 POST OFFICE SQUARE - SUITE 100
BOSTON, MASSACHUSETTS 02109-3012

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

April 22, 2011

Michael Gwyther, Station Superintendent
First Light Power Resources
Mount Tom Station
200 North Hampton Street
Holyoke, MA 01040

Re: Modification to EPA Information Request Letter, Dated February 15, 2011, for NPDES Permit Reissuance, NPDES Permit No: MA0005339

Dear Mr. Gwyther:

The New England Regional Office of the United States Environmental Protection Agency (EPA or Agency) is developing a draft National Pollutant Discharge Elimination System (NPDES) Permit (No. MA0005339) for FirstLight Power Resources Services, LLC's (FirstLight or the Company) Mount Tom Electric Generating Station, Holyoke, MA (MTS or Station). In support of this work, EPA sent FirstLight an information request letter, dated February 15, 2011 (EPA February 308 Letter), pursuant to Section 308(a) of the Clean Water Act (CWA), 33 U.S.C. §1318(a).

After receiving the EPA February 308 Letter, FirstLight contacted EPA and proposed a small number of minor modifications to the EPA information request. A conference call discussion took place between representatives of EPA and FirstLight on March 2, 2011, resulting in a Request for Minor Modification Letter that was sent by FirstLight to EPA, dated March 8, 2011. In addition, a March 30, 2011, e-mail was sent to EPA by Kleinschmidt Associates, representing FirstLight. Based on that information, EPA is amending the EPA February 308 Letter only in the parts provided below:

Information Request

I. Thermal Discharge Information Request

a. The request for information specified in this part has been satisfied. No further information is required under Part I (a).

b. Conduct a thermal plume analysis of Outfall 001 based on a Mount Tom Station heat transfer rate from the plant to the cooling water of 6.3×10^8 BTU's/hr. Submit to EPA the detailed impact of the thermal discharge on the Connecticut River under the following projected conditions:

1) a MTS discharge with a delta T of 26°F and a discharge temperature of 109°F during one pump operation using one circulating water pump and one river water pump (70 million gallons per day (MGD)). These operational conditions shall take place during a warm weather summer period (air temperature 95°F) accompanied by low flow conditions in the Connecticut River (approximately 3000 cfs).
2) a MTS discharge with a delta T of 26°F and a discharge temperature of 103°F during one pump operation using one circulating water pump and one river water pump (70 MGD). These operational conditions shall take place during representative spring (April – May) conditions (air temperature 65°F) accompanied by spring flow conditions in the Connecticut River (approximately 15,000 cfs).
3) a MTS discharge with a delta T of 13°F and a discharge temperature of 96°F during two pump operation using two circulating water pumps and two river water pumps (140 MGD). These operational conditions shall take place during a warm weather summer period (air temperature 95°F) accompanied by low flow conditions in the Connecticut River (approximately 3000 cfs).
4) a MTS discharge with a delta T of 13°F and a discharge temperature of 90°F during two pump operation using two circulating water pumps and two river water pumps (140 MGD). These operational conditions shall take place during representative spring (April – May) conditions (air temperature 65°F) accompanied by spring flow conditions in the Connecticut River (approximately 15,000 cfs).

Attachment A lists the number and type of Mount Tom Station thermal plume scenarios that will be submitted to EPA to satisfy the requirements of Part I (b).

II. Impingement and Entrainment Reduction Best Technology Available Information Request

Please provide the following information:

d. Provide information regarding the volume of discharge water expected and the specific thermal and chemical characteristics of the discharge each month using a Mechanical Draft Cooling Tower(s) closed cycle cooling system at Mount Tom Station. Include the dimensions and thermal characteristics of the reduced thermal plume in the Connecticut River for one winter and one summer condition.

h. Evaluate the expected performance of the Barrier Net at a pore size of 0.5 millimeters (mm) designed to eliminate or substantially reduce entrainment in the Connecticut River and provide the expected area of the net, location and anchoring needed for barrier nets of this pore size. Also include all costs.

i. Evaluate the reduction in entrainment of Connecticut River ichthyoplankton by using cylindrical wedge wire screen intakes with a mesh size of 0.5 mm. Discuss mortality estimates of ichthyoplankton that become trapped on the wedge wire screen. Determine the size and number of cylinders necessary to be able to use cylindrical screens of this slot size and evaluate the feasibility of installing and operating these units as well as the impacts associated with their placement and operation. Also include all costs.

III. Deliverable Schedule

a. The request specified in Part I.a. of this letter has been satisfied. No submittal is required.

b. Monthly progress reports are no longer required.

c. Submit all information requested in Parts I.b., I.c. and I.d. on May 31, 2011.

d. Submit the information requested in Part II. of this letter on May 31, 2011.

FirstLight must comply with all parts of the original information request letter (EPA February 308 Letter) that are not listed and clearly modified in this letter. Attachment I of the EPA February 308 Letter remains unchanged.

FirstLight may assert a business confidentiality claim with respect to part or all of the information submitted to EPA in the manner described at 40 CFR Part 2.203(b). Information covered by such a claim will be disclosed by EPA only to the extent, and by means, of the procedures set forth in 40 CFR Part 2, Subpart B. If no such claim accompanies the information when it is submitted to EPA, it may be made available to the public by EPA without further notice to FirstLight. Please note that effluent information may not be regarded as confidential.

Contact John Nagle of my staff (617) 918-1054 if you have questions regarding this request. The EPA looks forward to working with you on your new permit.

Sincerely,

Stephen S. Perkins, Director
Office of Ecosystem Protection

cc: Gerry Szal, MassDEP
David Webster, EPA
Julie Crocker, NMFS Protected Resources Division

ATTACHMENT A

Modification to EPA Information Request Letter, Dated February 15, 2011, for NPDES Permit Reissuance, NPDES Permit No: MA0005339

Mount Tom Station Thermal Plume Scenarios

Run Scenario	Discharge delta-T (deg F)	Pump Flow (MGD)	River Flow (cfs)	Ambient Water Temp (deg F)
1	13	70	3,000	77
2	13	70	3,000	83
3	13	70	15,000	77
4	13	70	15,000	83
5	13	140	3,000	77
6	13	140	3,000	83
7	13	140	15,000	77
8	13	140	15,000	83
9	26	70	3,000	77
10	26	70	3,000	83
11	26	70	15,000	77
12	26	70	15,000	83
13	26	140	3,000	77
14	26	140	3,000	83
15	26	140	15,000	77
16	26	140	15,000	83

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5087
http://www.fws.gov/northeast/newenglandfieldoffice

REF: NPDES Permit No. MA0005339
FirstLight Power Resources Services, LLC
Mount Tom Generating Station
COMMENTS ON ICHTHYOPLANKTON DATA REPORT

December 22, 2010

Ms. Sharon DeMeo
U.S. Environmental Protection Agency, Region 1
One Congress Street, Suite 1100 (CMA)
Boston, MA 02114-2023

Dear Ms. DeMeo:

This responds to the November 23, 2010 cover letter and accompanying Ichthyoplankton Data Report submitted to you by Kleinschmidt Energy & Water Resource Consultants (Kleinschmidt) for the Mount Tom Generating Station (Mount Tom), located on the Connecticut River in Holyoke, Massachusetts. We have reviewed the report and provide the following comments.

OVERVIEW

In accordance with the scope of study prescribed by the U.S. Environmental Protection Agency Region 1 (EPA), the report presents the results of a two-year monitoring study conducted to characterize ichthyoplankton entrainment occurring at Mount Tom between October 2008 and September 2010.

Ichthyoplankton samples were collected at the cooling water intake structure (CWIS) one day per week from March through September, with one sample collected during the day and one at night. From October through February, entrainment samples were collected twice per month (every other week) for a period of two years.

In addition, ichthyoplankton was sampled in the Connecticut River one day per week during the months of April, July, August and September for a period of two years at three evenly-spaced locations just upstream from Mount Tom.

RESULTS

Over 2.5 million larvae of 13 different taxonomic categories were estimated to be entrained in year 1, while in year 2, over 10 million larvae from 12 taxonomic categories were estimated to be entrained. In both years, the entrainment was highest during the month of June. In year 1, the months of May, June and July accounted for 99% of the entrainment, and in year 2, the months of May and June accounted for more than 99% of the entrainment. There was no statistical difference in day and night entrainment rates. Very few larvae were sampled from the river. Differences in monthly entrainment estimates between the two sample years were determined to be due, in part, to differences in the volume of cooling water used by the station and the number of days the station was out of service.

COMMENTS

In-River Sampling

According to the report, due to concerns over potential collection of endangered shortnose sturgeon eggs and/or larvae, a modification was made to the original sampling protocol to omit in-river sampling during the months of May and June. It is unclear why the change was needed, given that the Holyoke Water Power Company's Proposal for Information Collection (Kleinschmidt October 2006)[1] stated that the National Marine Fisheries Service did not believe entrainment of shortnose sturgeon eggs and larvae at Mount Tom was a concern because sturgeon spawning occurs about 20 miles upstream of Mount Tom, the eggs are demersal and adhesive, and larvae do not disperse far downstream from their local spawning grounds.

Regardless, it is unfortunate that no in-river sampling occurred during May and June of either sample year, given that those were the months of highest entrainment (along with July 2009). Having those data would enable a comparison of the densities of larvae entrained to the offshore density of larvae by species during the period of highest entrainment.

Laboratory Processing of Samples

The report states that select fish larvae were measured to the nearest 0.1 mm (total length); however, nowhere in the report are the results of those data provided.

Larval Herring Entrainment and Adult Equivalent Loss

Table 3 of the report provides a summary of larval entrainment estimates by month. For year 1 (2009), over 300,000 herring species[2] were entrained, and over 400,000 sea lamprey. In year 2 (2010), over 1.6 million herring larvae were entrained.

---

1 Mount Tom Generating Station Proposal for Information Collection. October 2006. Prepared by Kleinschmidt Energy & Water Resource Consultants. Section 5(d), page 30.

2 The report does not distinguish between the different Clupeidae species; however, in both study years, the vast majority of clupeid larvae likely were American shad, given that the numbers of adult gizzard shad and blueback herring passed upstream of the Holyoke Dam (e.g., 370 and 76, respectively, in year 2) were negligible compared to American shad (e.g., 164,439 in year 2).

Section 5.5 of the report assesses the potential population impact of larval herring entrainment. Based on published survival fractions, Kleinschmidt estimates the number of "equivalent adults" lost to entrainment at Mount Tom annually to be less than one individual. While the equations used to derive equivalent adult estimates were provided in the report, the species-specific survival rates used in the calculations were not provided. Based on a larvae to adult (L/A) ratio of 178:1,[3] the number of equivalent adults lost to entrainment at Mount Tom during the study period would be over 1,600 fish in year 1 and nearly 9,000 fish in year 2. Even using a more recent estimated ratio of 400:1[4] would result in adult equivalent losses of approximately 750 fish in year 1 and 4,000 fish in year 2.

Another way to determine entrainment impact is to use life-stage specific survival rates for American shad to calculate how many of those larvae would have been expected to survive but for becoming entrained at Mount Tom (Table 1).

Table 1. Survival estimates for 1.6 million larval American shad, based on age-based survival rates developed by Crecco et al. (1983).[5]

Day	Survival D4	Survival D10	Survival D19	Survival D29	Survival D33
4	1216800				
5	925376				
6	703749				
7	535201				
8	407020				
9	309539				
10	264346	1366400			
11	225752	1166906			
12	192792	996537			
13	164644	851043			
14	140606	726791			
15	120078	620679			
16	102546	530060			
17	87575	452671			
18	74789	386581			
19	67983	351402	1454400		
20	61797	319425	1322050		
21	56173	290357	1201743		
22	51061	263935	1092384		

[3] Hendricks, M.L. Analysis of adult American shad otoliths. 2004. Abridged report for PFBC website. http://www.fish.state.pa.us/pafish/shad/reports_technical/2004/otoliths.htm.

[4] Pers. comm.. with Mike Hendricks, Pennsylvania Fish and Boat Commission. December 16, 2010. Note that this larvae to adult ratio was derived using hatchery larvae, which were stocked out anywhere from 10 to 30 days of age.

[5] Crecco, V., T. Savoy and L. Gunn. Daily Mortality Rates of Larval and Juvenile American Shad (*Alosa sapidissima*) in the Connecticut River with Changes in Year-Class Strength. 1983. Canadian Journal of Fisheries and Aquatic Sciences. 40: 1719-1728. Average age-based survival rates from 1979-1982 were found to be: days 4-9 – 0.761; days 10-18 – 0.854; days 19-28 – 0.909; days 29-33 – 0.942; days 34-80 – 0.982.

23	46415	239917	992977		
24	42191	218084	902617		
25	38352	198238	820478		
26	34862	180199	745815		
27	31689	163801	677946		
28	28805	148895	616253		
29	27135	140259	580510	1507200	
30	25561	132124	546840	1419782	
31	24078	124461	515124	1337435	
32	22682	117242	485247	1259864	
33	21366	110442	457102	1186792	
34					1571200
80	9098	47030	194649	505376	681334

Table 1 shows that, depending on how old the larvae were, anywhere from 9,000 to over 680,000 of them could have survived to outmigration if they had not been entrained. We understand that there likely are multiple larval cohorts in the river, but unfortunately the report provides no data on the age structure of entrained larvae, nor any information on shad larvae within the Connecticut River. Absent these important pieces of information, Table 1 provides only a coarse-level analysis of potential impact due to entrainment.

Using larvae-to-adult ratios of 178:1 to 400:1, if all entrained larvae were near the age of metamorphosis, between 4,000 and 8,800 adults (2.5 percent to 5.5 percent of the number of shad passed at Holyoke Dam in 2010) would be lost from the population. This is a cause for concern for the following reasons:

Status of Stock

A 2007 American shad stock assessment found that coast-wide stocks were at all-time lows and did not appear to be recovering to acceptable levels. In response, the Atlantic States Marine Fisheries Commission (ASMFC) developed Amendment 3 to the Interstate Fishery Management Plan for Shad and River Herring.[6] The goal of Amendment 3 is to protect, enhance, and restore Atlantic coast migratory stocks and critical habitat of American shad in order to achieve levels of spawning stock biomass that are sustainable, can produce a harvestable surplus, and are robust enough to withstand unforeseen threats.

One of the objectives identified in the report is to maximize the number of juvenile recruits emigrating from freshwater stock complexes. Amendment 3 states that protecting, restoring, and enhancing American shad habitat, including spawning, nursery, rearing, production, and migration areas, are critical objectives necessary for preventing further declines in shad abundance. Two of the identified threats to shad habitat are water withdrawals and thermal wastewater discharge. Specific measures recommended for habitat restoration, enhancement, utilization and protection include scrutinizing projects involving water withdrawal to ensure that

6 Amendment 3 to the Interstate Fishery Management Plan for Shad and River Herring (American Shad Management). Atlantic States Marine Fisheries Commission. February 2010.

adverse impacts resulting from impingement, entrainment, and/or modifications of flow and salinity regimes due to water removal will not adversely impact diadromous fish stocks.

Importance of Larval Survival

Early life history of American shad within the Connecticut River was well-studied by Crecco et al. (1983)[7] and Crecco and Savoy (1985).[8] Based on the results of those studies, the researchers concluded the following:

1. Larval mortality rates are highest among first-feeding larvae, and then decline steadily throughout larval development.
2. Year-class strength of Connecticut River shad appears to be established by the end of the larval period.
3. The determination of year-class strength during the early larval period is significant because all subsequent losses during the larval and juvenile stages affect subsequent adult recruits returning to natal rivers to spawn.[9]

Cumulative Impacts

Even if the estimated numbers of lost adult equivalents is low relative to the total number of shad passed at Holyoke Dam, entrainment at Mount Tom is only one of many sources of mortality for shad within the Connecticut River. In addition to other water withdrawals and thermal effluent, there are hydropower dams that also entrain and/or impinge fish. The cumulative effect of all of these sources combined could impact the long-term sustainability of the Connecticut River shad run.

These factors, in conjunction with the results of the entrainment study, lead the U.S. Fish and Wildlife Service (Service) to conclude that further and more rigorous entrainment monitoring is warranted at Mount Tom.

RECOMMENDATIONS

Based on the results of the report, the Service recommends that FirstLight Power Resources Services continue entrainment sampling for at least two more years, with the following modifications to the sampling protocol:

1. the frequency of sampling should be increased to two times per week in June;
2. concurrent in-river sampling should be conducted in May and June;[10] and
3. collected "herring" larvae (or a subsample of larvae) should be measured, and those raw data should be provided in spreadsheet format on a CD as an appendix to the report. This

---

7 Refer to Footnote #4.

8 Crecco, V. and T. Savoy. Effect of Biotic and Abiotic Factors on Growth and Relative Survival of Young American Shad, *Alosa sapidissima*, in the Connecticut River. 1985. Canadian Journal of Fisheries and Aquatic Sciences. 42: 1640-1648.

9 Savoy, T.F., V.A. Crecco and B.C. Marcy. American Shad Early Life History and Recruitment in the Connecticut River: A 40-Year Summary. In American Fisheries Society Monograph 9: 407-417, 2004. The Connecticut River Ecological Study (1965-1973) Revisited: Ecology of the Lower Connecticut River 1973-2003.

10 Contingent upon receiving approval from the National Marine Fisheries Service.

information will allow the Service to use published age-at-length curves and age-based survival estimates to evaluate the potential impact of entrainment mortality on the Connecticut River shad stock.

Thank you for this opportunity to comment. If you have any questions regarding these comments, please contact Melissa Grader of this office at (413) 548-8002, extension 124.

Sincerely yours,

Thomas R. Chapman
Supervisor
New England Field Office

cc: Christine Tomichek, Kleinschmidt
35 Pratt Street, Suite 201
Essex, CT 06426
NMFS, Julie Crocker
CT River Coordinator, Ken Sprankle
MA DEP, Bob Kubit
MA DFW, Caleb Slater
Steve Gephard, CT DEP
Reading File

ES: MGrader:12-22-10:(603)223-2541

APPENDIX B
FIGURES

Legend

▲ Discharge

D13SPLFA77 Delta T (F)

- 1.52
- 1.53 - 3.5
- 3.51 - 5.5
- 5.51 - 7.5
- 7.51 - 9.5
- 9.51 - 11.5
- 11.6 - 13.5

0 25 50 100 Meters

Scale: AS SHOWN	FirstLight Power Resources Power Services, LLC. Holyoke, MA	FIGURE
Project No: 1503-037	Response to EPA Information Request	
Filename: D13SPLFA77_plan.mxd	D13SPLFA77 PLAN VIEW	
Drawn By: KPN	Kleinschmidt Energy & Water Resource Consultants 141 Main St., PO Box 650 Pittsfield, Maine 04967 Telephone: (207) 487-3328 Fax: (207) 487-3124 www.KleinschmidtUSA.com	1
Date Drawn: 04-22-2011		


N
Connecticut River
Legend
Discharge
D13SPLFA83 Delta T (F)
1.5
1.6 - 3.5
3.6 - 5.5
5.6 - 7.5
7.6 - 9.5
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Scale: AS SHOWN
Project No: 1503-037
Filename: D13SPLFA83_plan.mxd
Drawn By: KPN
Date Drawn: 04-22-2011
FirstLight Power Resources Power Services, LLC.
Holyoke, MA
Response to EPA
Information Request
D13SPLFA83
PLAN VIEW
Kleinschmidt
Energy & Water Resource Consultants
141 Main St., PO Box 650
Pittsfield, Maine 04967
Telephone: (207) 487-3328
Fax: (207) 487-3124
www.KleinschmidtUSA.com
FIGURE
2

Scale: AS SHOWN	FirstLight Power Resources Power Services, LLC. Holyoke, MA	FIGURE
Project No: 1503-037	Response to EPA Information Request	
Filename: D13SPLFA83_plan.mxd	D13SPHFA77 PLAN VIEW	3
Drawn By: KPN	Kleinschmidt Energy & Water Resource Consultants 141 Main St., PO Box 650 Pittsfield, Maine 04967 Telephone: (207) 487-3328 Fax: (207) 487-3124 www.KleinschmidtUSA.com	
Date Drawn: 04-22-2011		


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Discharge
D13SPHFA83 Delta T (F)
1.5
1.6 - 3
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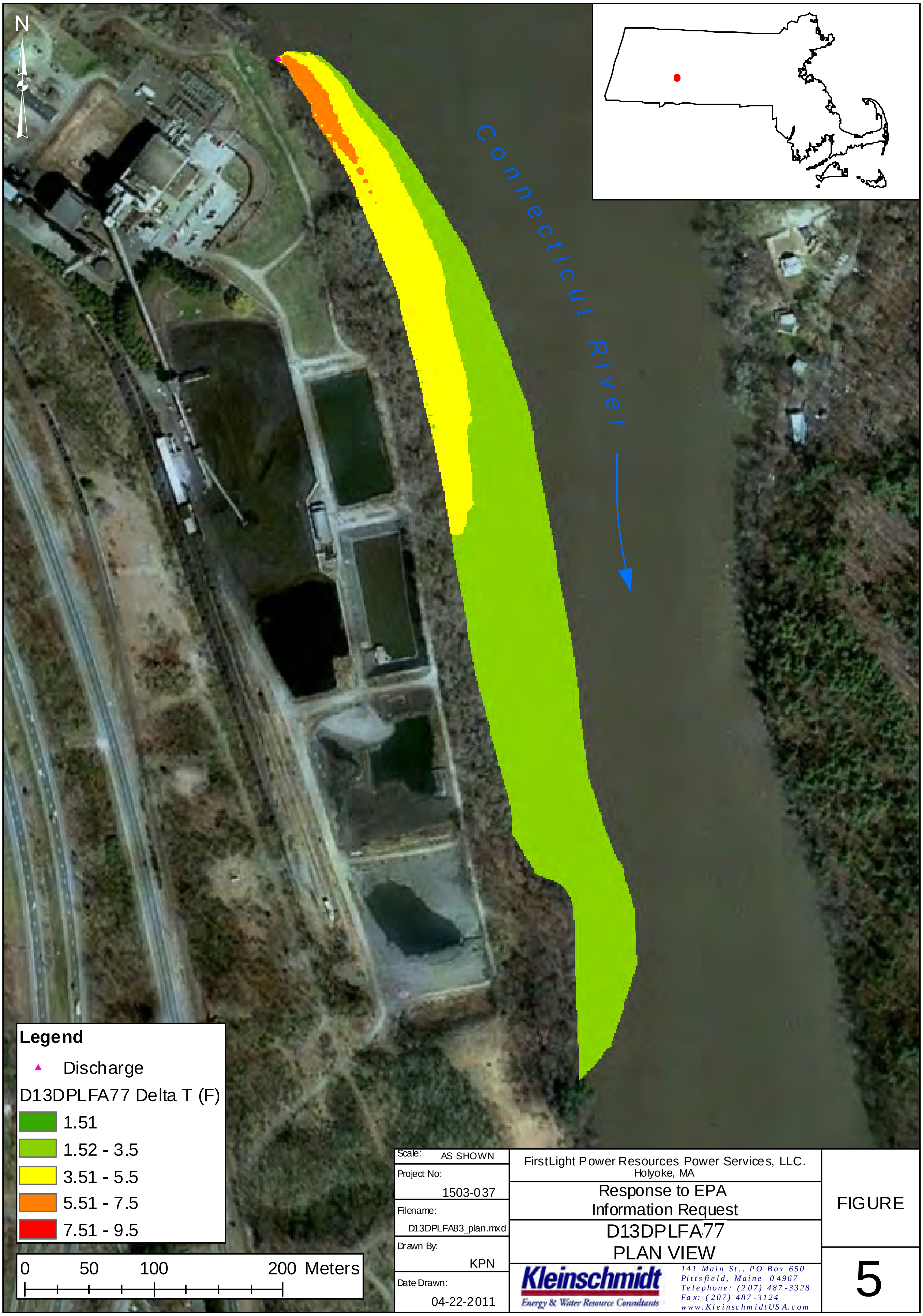
Filename: D13SPHFA83_plan.mxd
Drawn By: KPN
Date Drawn: 04-22-2011
FirstLight Power Resources Power Services, LLC.
Holyoke, MA
Response to EPA
Information Request
D13SPHFA83
PLAN VIEW
Kleinschmidt
Energy & Water Resource Consultants
141 Main St., PO Box 650
Pittsfield, Maine 04967
Telephone: (207) 487-3328
Fax: (207) 487-3124
www.KleinschmidtUSA.com
FIGURE
4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Connecticut River
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Discharge
D13DPLFA77 Delta T (F)
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Scale: AS SHOWN
Project No: 1503-037
Filename: D13DPLFA83_plan.mxd
Drawn By: KPN
Date Drawn: 04-22-2011
FirstLight Power Resources Power Services, LLC.
Holyoke, MA
Response to EPA
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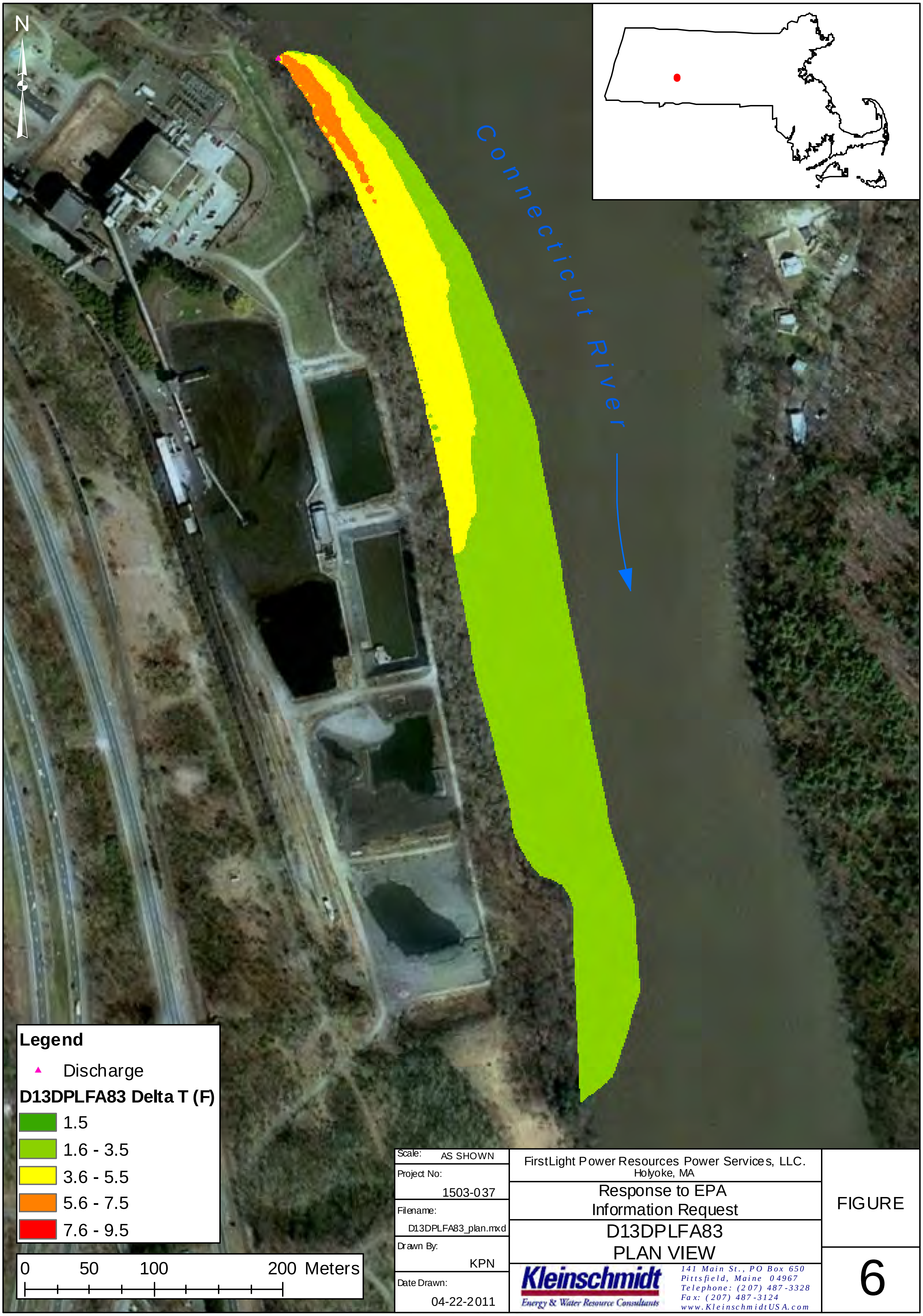
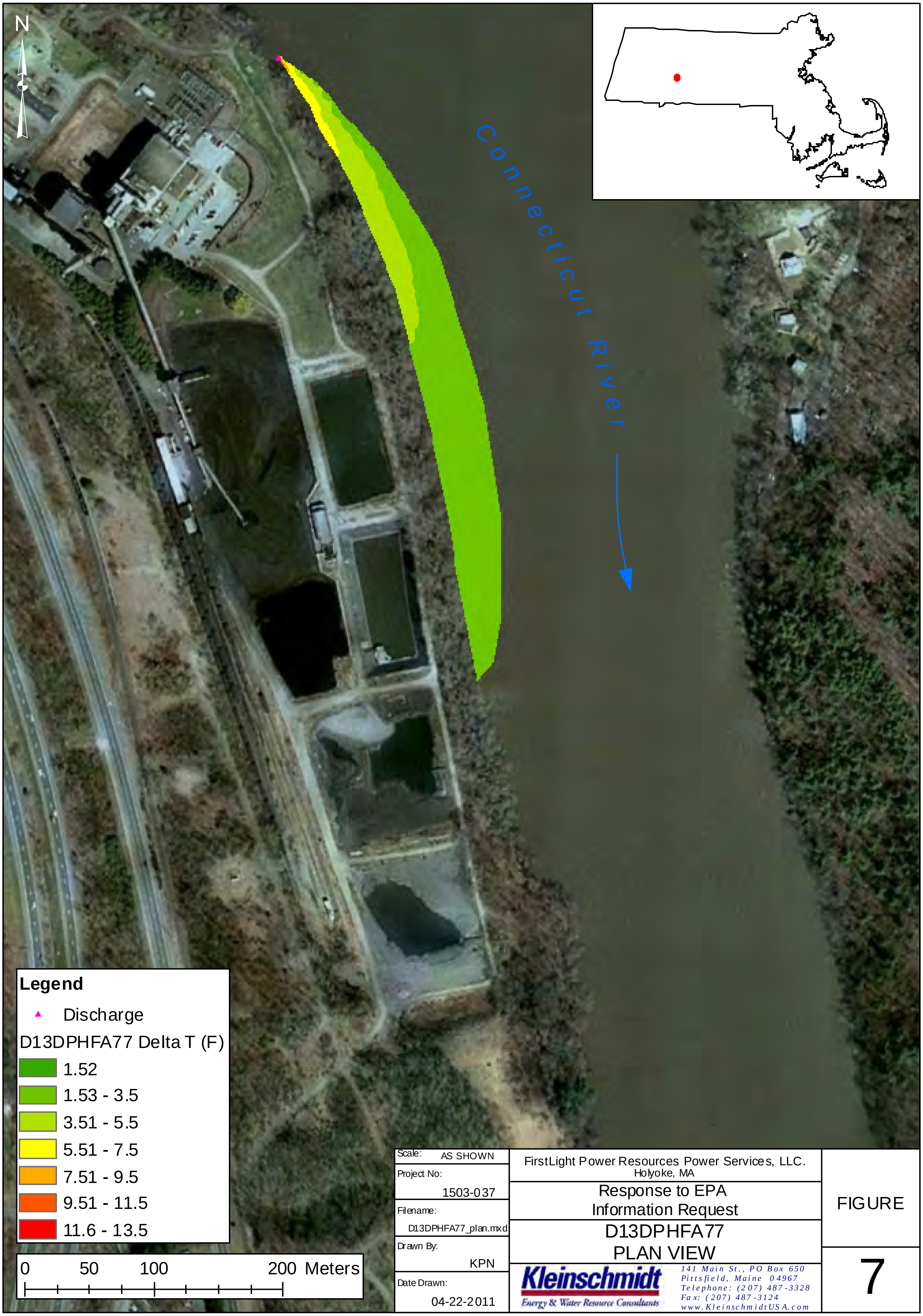
141 Main St., PO Box 650
Pittsfield, Maine 04967
Telephone: (207) 487-3328
Fax: (207) 487-3124
www.KleinschmidtUSA.com
FIGURE
5



Scale: AS SHOWN	FirstLight Power Resources Power Services, LLC. Holyoke, MA	FIGURE
Project No: 1503-037	Response to EPA Information Request	
Filename: D13DPLFA83_plan.mxd	D13DPLFA83 PLAN VIEW	6
Drawn By: KPN	Kleinschmidt Energy & Water Resource Consultants 141 Main St., PO Box 650 Pittsfield, Maine 04967 Telephone: (207) 487-3328 Fax: (207) 487-3124 www.KleinschmidtUSA.com	
Date Drawn: 04-22-2011		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Connecticut River
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Discharge
D13DPHFA77 Delta T (F)
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9.51 - 11.5
11.6 - 13.5
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Scale: AS SHOWN
Project No: 1503-037
Filename: D13DPHFA77_plan.mxd
Drawn By: KPN
Date Drawn: 04-22-2011
FirstLight Power Resources Power Services, LLC.
Holyoke, MA
Response to EPA
Information Request
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Telephone: (207) 487-3328
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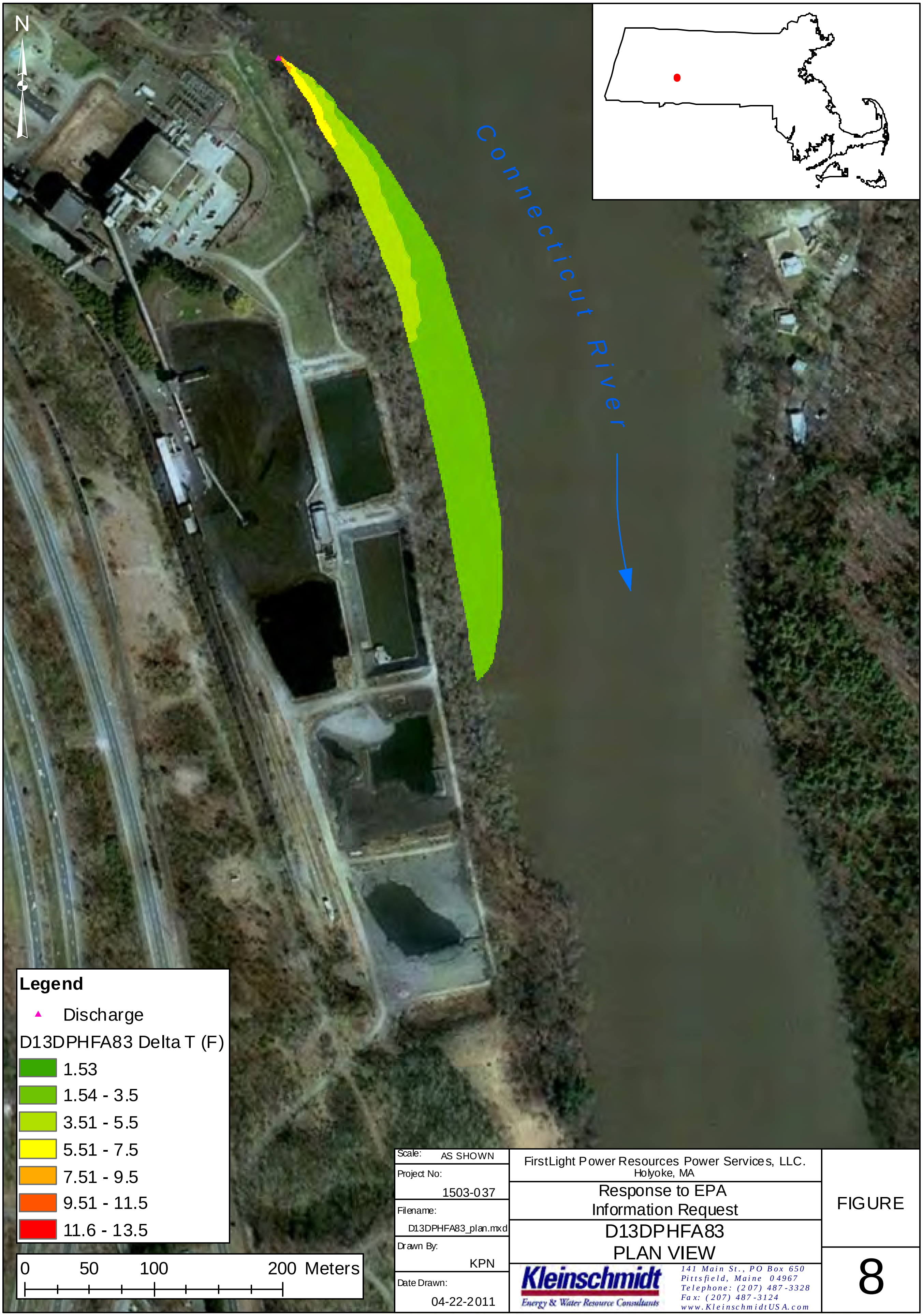
www.KleinschmidtUSA.com
FIGURE
7



N
Connecticut River
Legend
Discharge
D13DPHFA83 Delta T (F)
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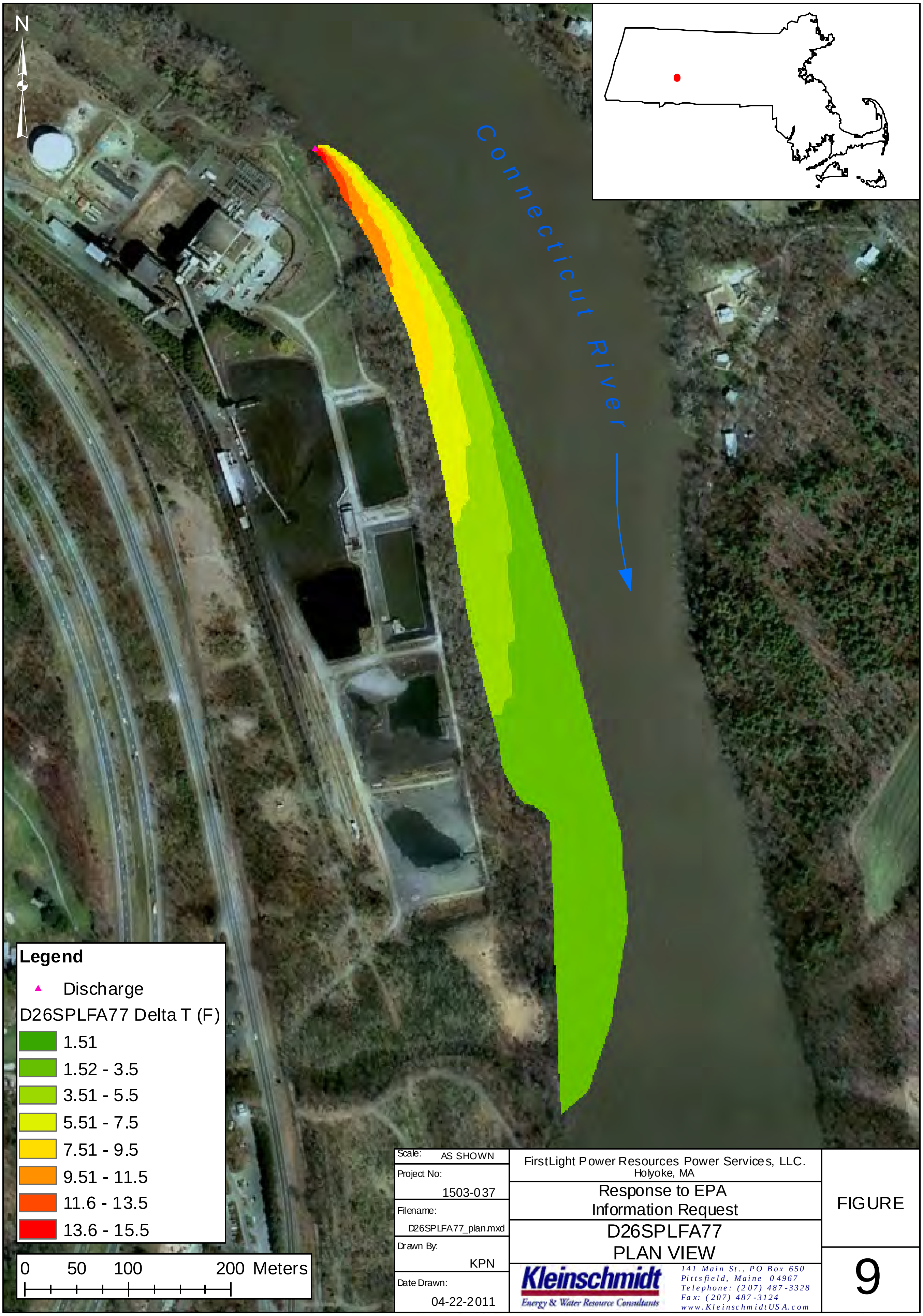
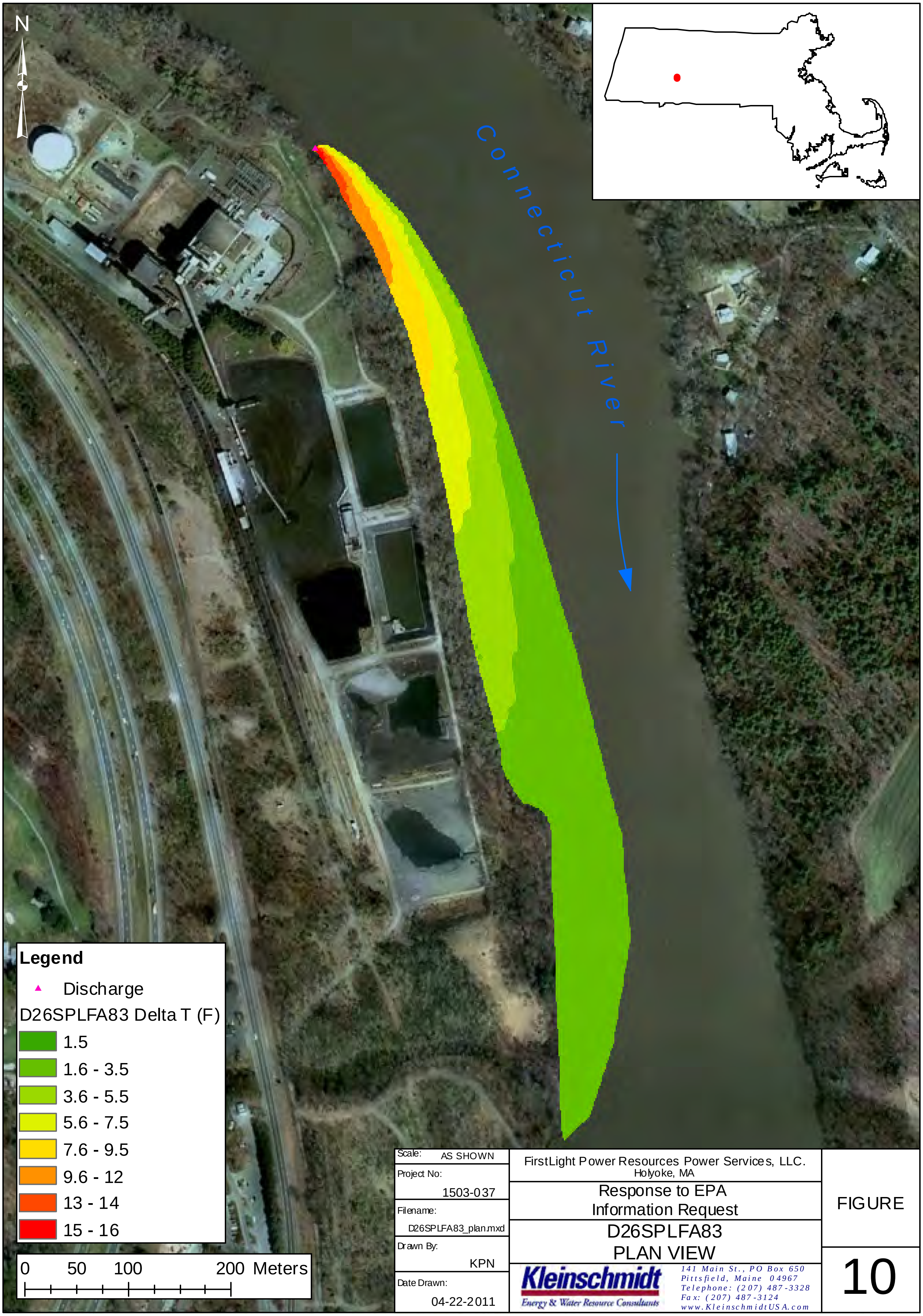
1.54 - 3.5
3.51 - 5.5
5.51 - 7.5
7.51 - 9.5
9.51 - 11.5
11.6 - 13.5
0 50 100 200 Meters
Scale: AS SHOWN
Project No: 1503-037
Filename: D13DPHFA83_plan.mxd
Drawn By: KPN
Date Drawn: 04-22-2011
FirstLight Power Resources Power Services, LLC.
Holyoke, MA
Response to EPA
Information Request
D13DPHFA83
PLAN VIEW
Kleinschmidt
Energy & Water Resource Consultants
141 Main St., PO Box 650
Pittsfield, Maine 04967
Telephone: (207) 487-3328
Fax: (207) 487-3124
www.KleinschmidtUSA.com
FIGURE
8



N
Connecticut River
Legend
Discharge
D26SPLFA77 Delta T (F)
1.51
1.52 - 3.5
3.51 - 5.5
5.51 - 7.5
7.51 - 9.5
9.51 - 11.5
11.6 - 13.5
13.6 - 15.5
0 50 100 200 Meters
Scale: AS SHOWN
Project No: 1503-037
Filename: D26SPLFA77_plan.mxd
Drawn By: KPN
Date Drawn: 04-22-2011
FirstLight Power Resources Power Services, LLC.
Holyoke, MA
Response to EPA
Information Request
D26SPLFA77
PLAN VIEW
Kleinschmidt
Energy & Water Resource Consultants
141 Main St., PO Box 650
Pittsfield, Maine 04967
Telephone: (207) 487-3328
Fax: (207) 487-3124
www.KleinschmidtUSA.com
FIGURE
9


N
Connecticut River
Legend
Discharge
D26SPLFA83 Delta T (F)
1.5
1.6 - 3.5
3.6 - 5.5
5.6 - 7.5
7.6 - 9.5
9.6 - 12
13 - 14
15 - 16
0 50 100 200 Meters
Scale: AS SHOWN
Project No: 1503-037
Filename: D26SPLFA83_plan.mxd
Drawn By: KPN
Date Drawn: 04-22-2011
FirstLight Power Resources Power Services, LLC.
Holyoke, MA
Response to EPA
Information Request
D26SPLFA83
PLAN VIEW
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Pittsfield, Maine 04967
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FIGURE
10

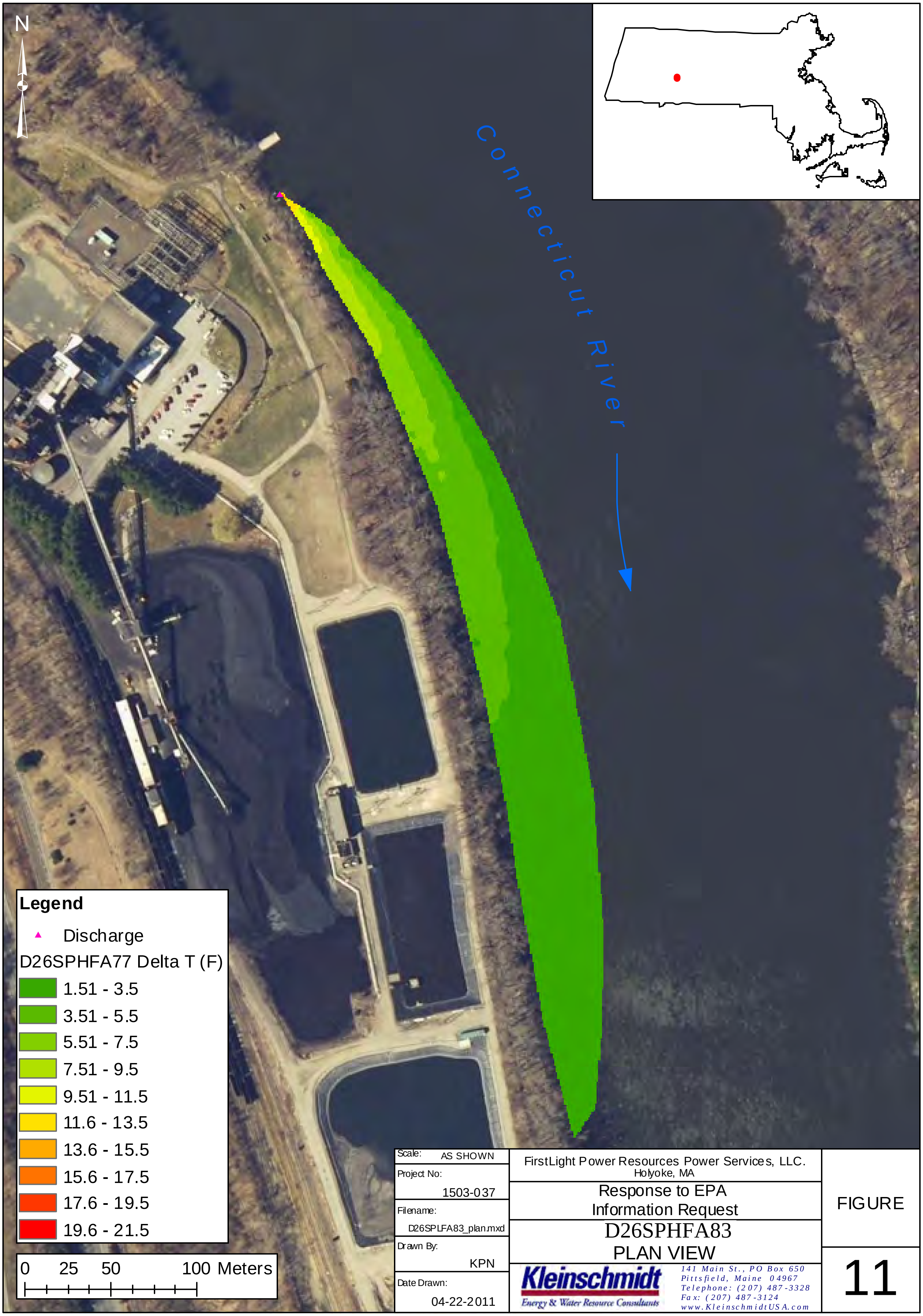
N
Connecticut River
Legend
Discharge
D26SPHFA77 Delta T (F)
1.51 - 3.5
3.51 - 5.5
5.51 - 7.5
7.51 - 9.5
9.51 - 11.5
11.6 - 13.5
13.6 - 15.5
15.6 - 17.5
17.6 - 19.5
19.6 - 21.5
0 25 50 100 Meters
Scale: AS SHOWN
Project No: 1503-037
Filename: D26SPLFA83_plan.mxd
Drawn By: KPN
Date Drawn: 04-22-2011
FirstLight Power Resources Power Services, LLC.
Holyoke, MA
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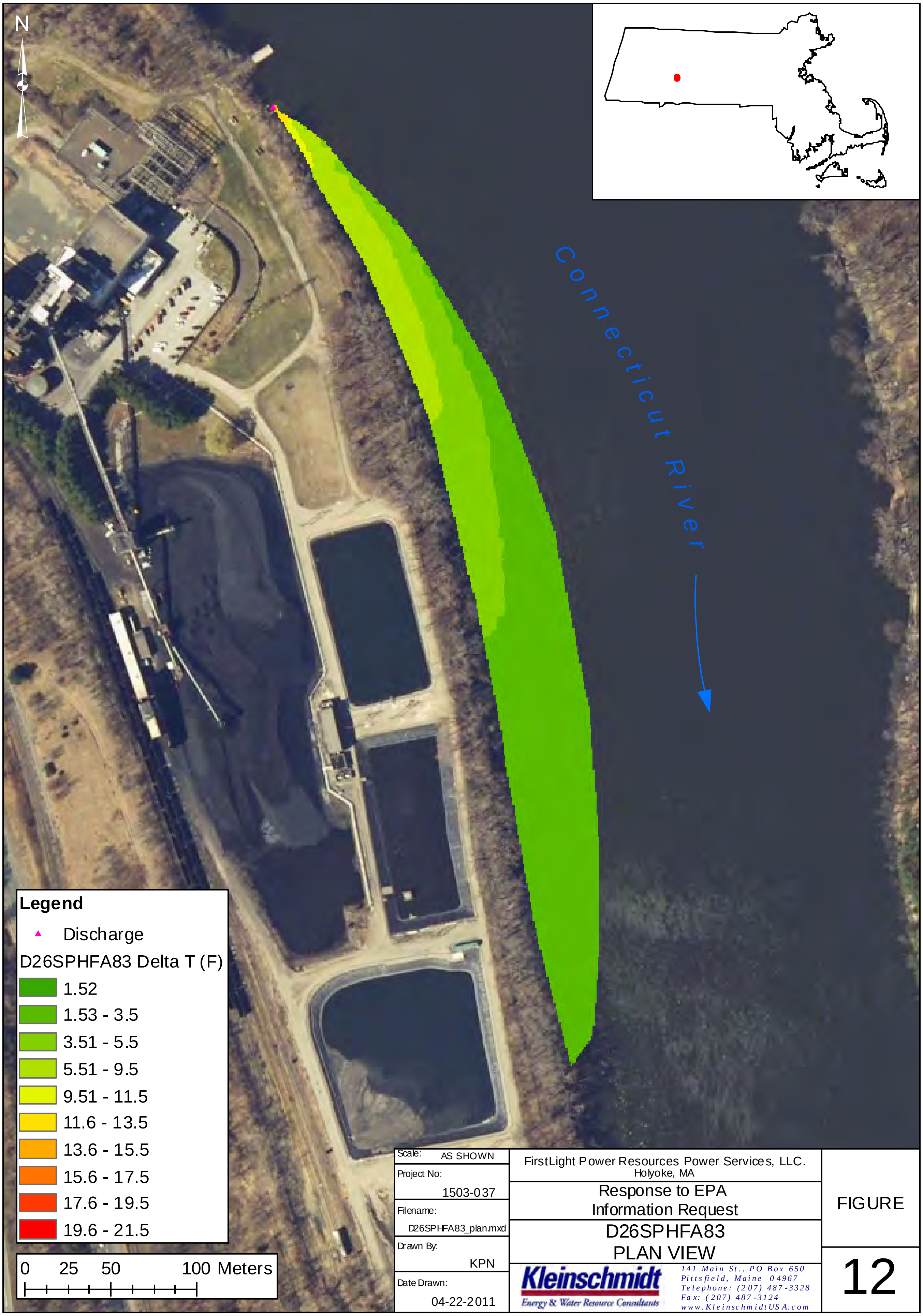
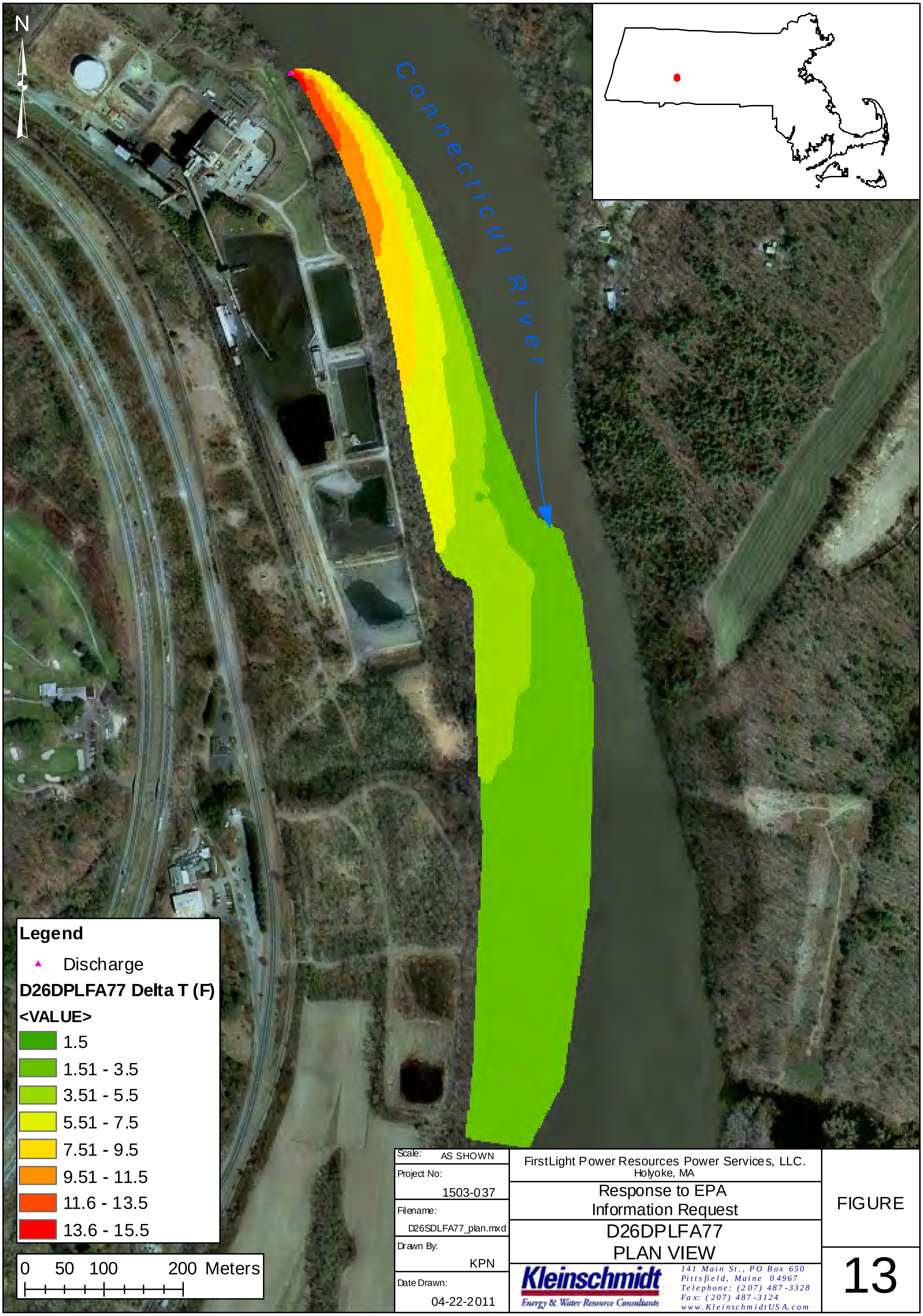
FIGURE
11



Scale: AS SHOWN	FirstLight Power Resources Power Services, LLC. Holyoke, MA	FIGURE
Project No: 1503-037	Response to EPA Information Request	
Filename: D26SPHFA83_plan.mxd	D26SPHFA83 PLAN VIEW	
Drawn By: KPN		12
Date Drawn: 04-22-2011	Kleinschmidt Energy & Water Resource Consultants 141 Main St., PO Box 650 Pittsfield, Maine 04967 Telephone: (207) 487-3328 Fax: (207) 487-3124 www.KleinschmidtUSA.com	


N
Connecticut River
Legend
Discharge
D26DPLFA77 Delta T (F)
<VALUE>
1.5
1.51 - 3.5
3.51 - 5.5
5.51 - 7.5
7.51 - 9.5
9.51 - 11.5
11.6 - 13.5
13.6 - 15.5
0 50 100 200 Meters
Scale: AS SHOWN
Project No: 1503-037
Filename: D26SDLFA77_plan.mxd
Drawn By: KPN
Date Drawn: 04-22-2011
FirstLight Power Resources Power Services, LLC.
Holyoke, MA
Response to EPA
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D26DPLFA77
PLAN VIEW
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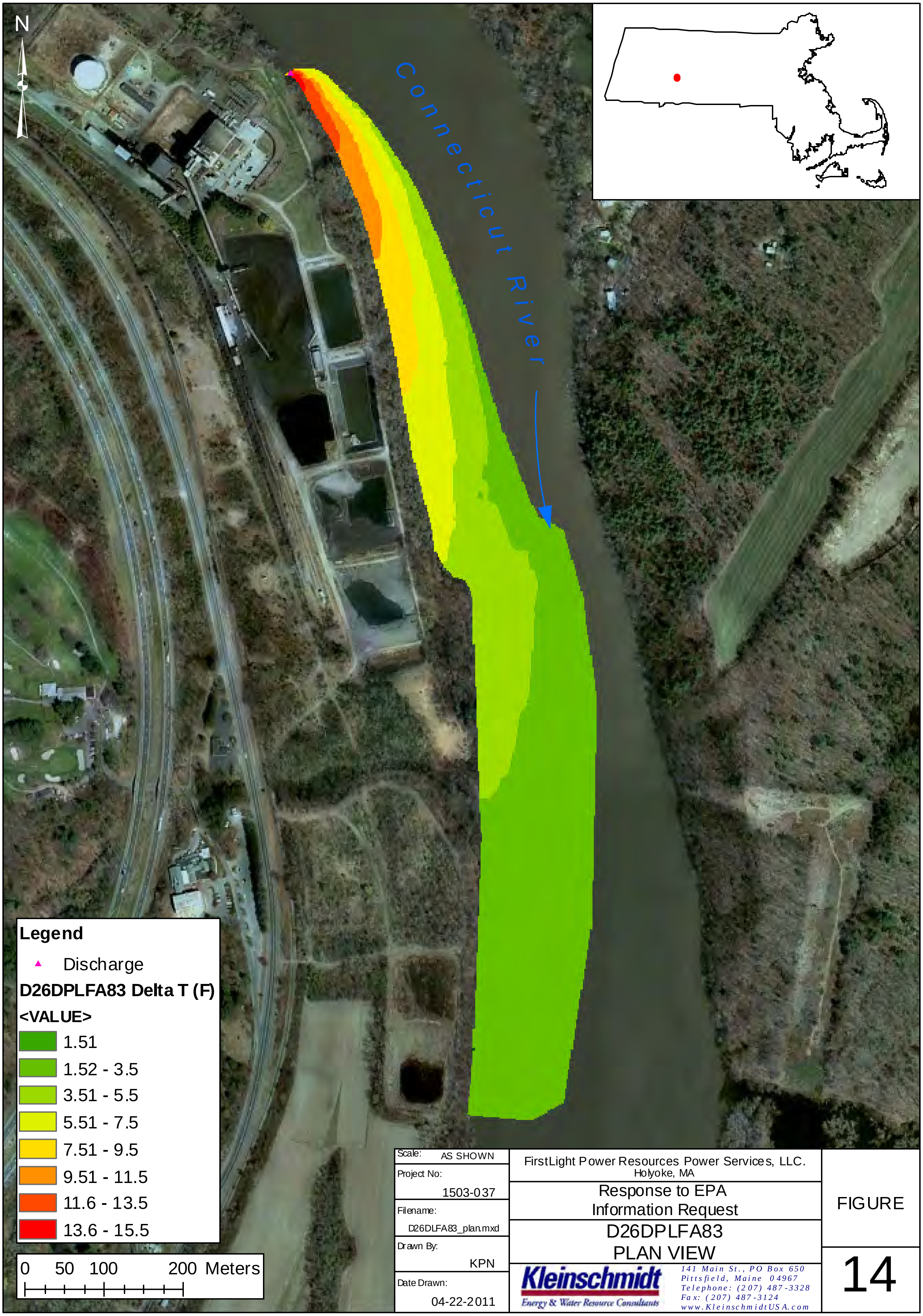
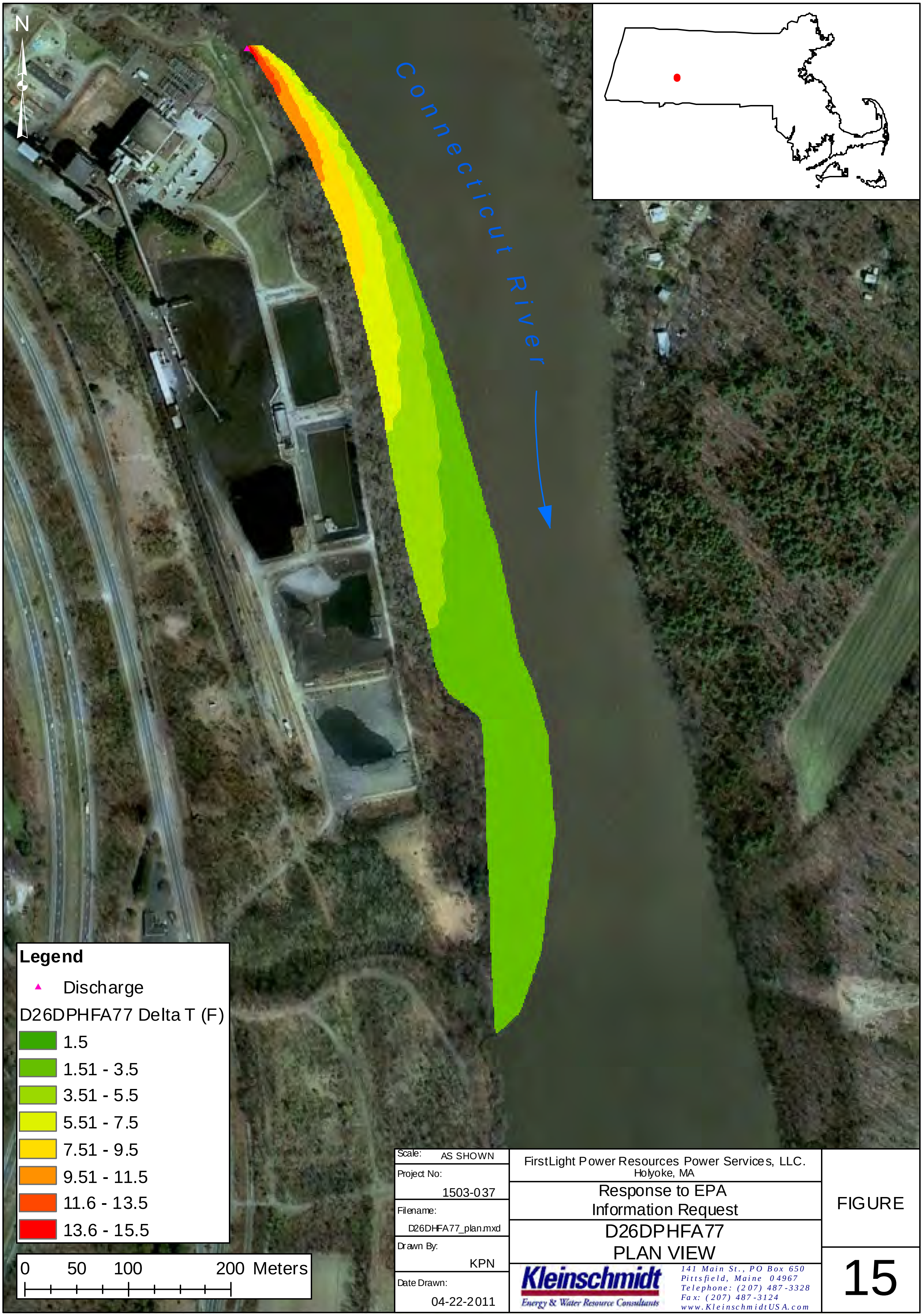
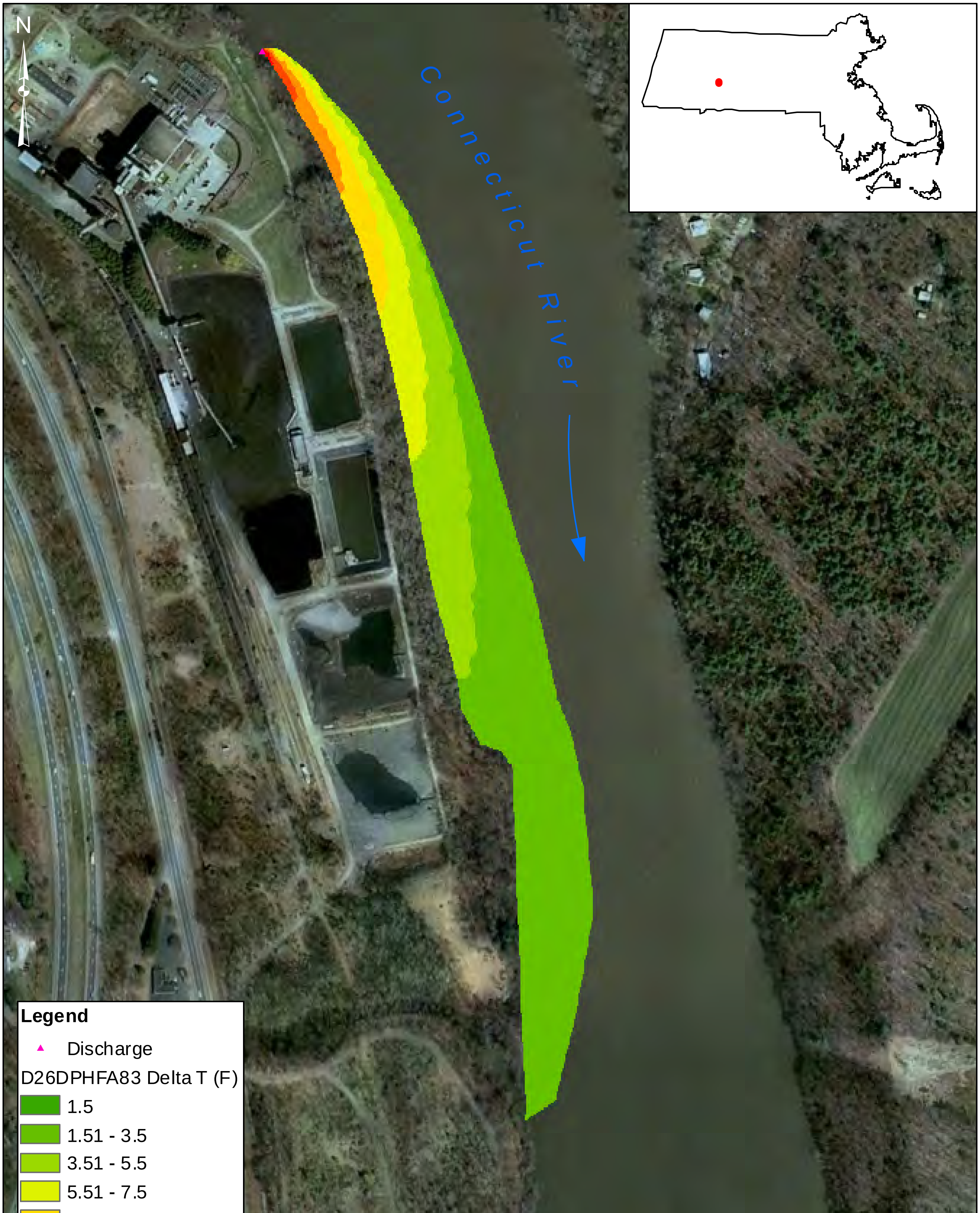
FIGURE
13



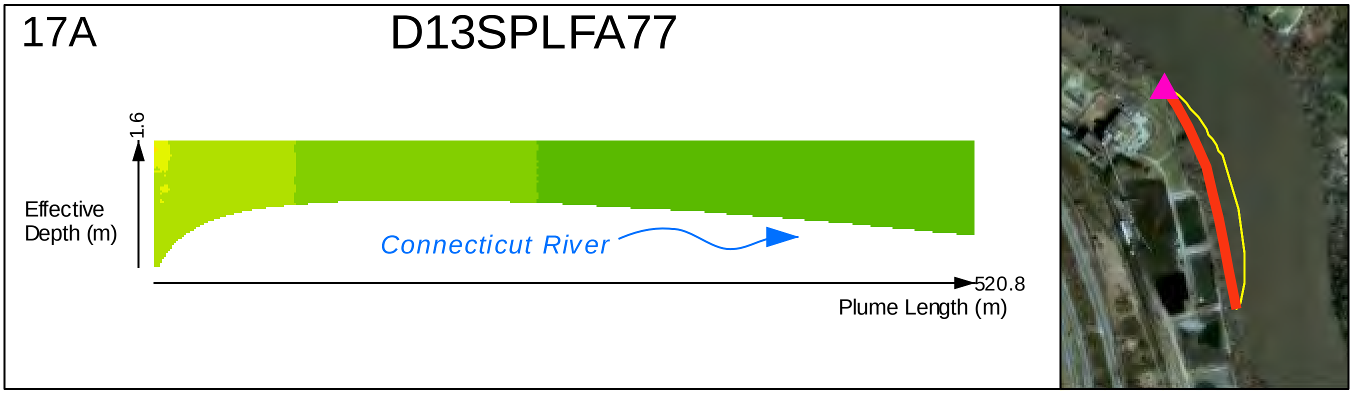
Scale: AS SHOWN	FirstLight Power Resources Power Services, LLC. Holyoke, MA	FIGURE
Project No: 1503-037	Response to EPA Information Request	
Filename: D26DLFA83_plan.mxd	D26DPLFA83 PLAN VIEW	
Drawn By: KPN	Kleinschmidt Energy & Water Resource Consultants 141 Main St., PO Box 650 Pittsfield, Maine 04967 Telephone: (207) 487-3328 Fax: (207) 487-3124 www.KleinschmidtUSA.com	14
Date Drawn: 04-22-2011		

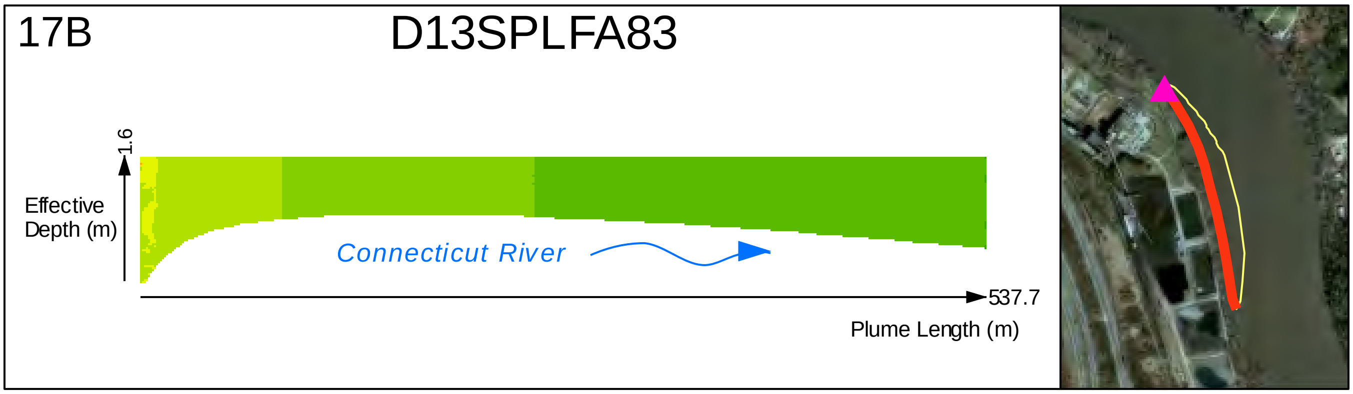


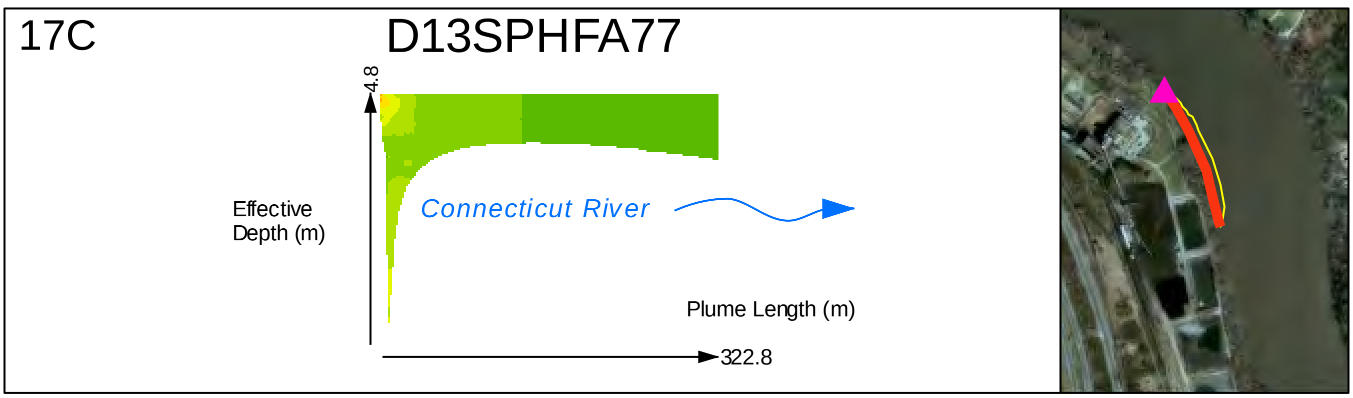
Scale: AS SHOWN	FirstLight Power Resources Power Services, LLC. Holyoke, MA	FIGURE
Project No: 1503-037	Response to EPA Information Request	
Filename: D26DHFA77_plan.mxd	D26DPHFA77 PLAN VIEW	
Drawn By: KPN		
Date Drawn: 04-22-2011	Kleinschmidt Energy & Water Resource Consultants 141 Main St., PO Box 650 Pittsfield, Maine 04967 Telephone: (207) 487-3328 Fax: (207) 487-3124 www.KleinschmidtUSA.com	15

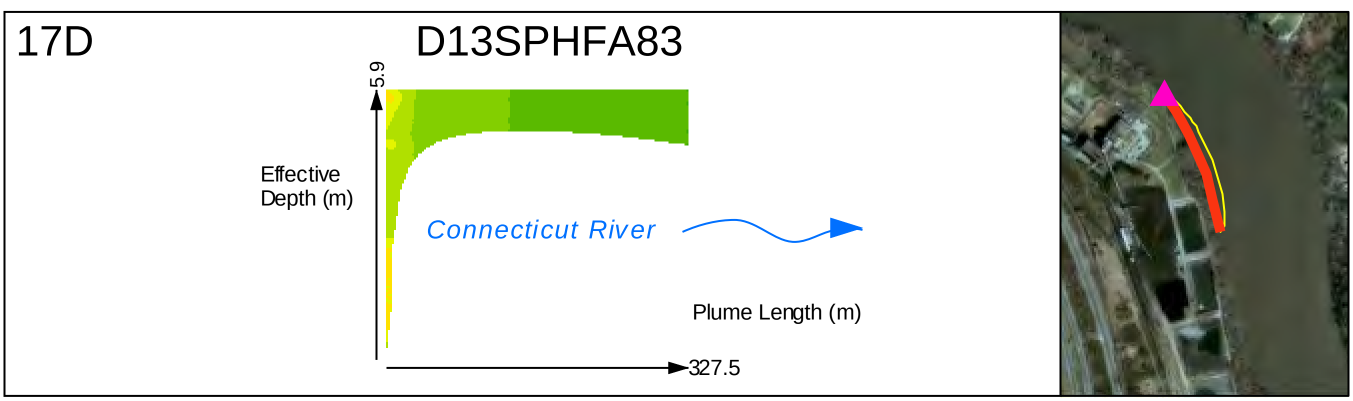


Scale: AS SHOWN	FirstLight Power Resources Power Services, LLC. Holyoke, MA	FIGURE
Project No: 1503-037	Response to EPA Information Request	
Filename: D26DHFA83_plan.mxd	D26DPHFA83 PLAN VIEW	
Drawn By: KPN		16
Date Drawn: 04-22-2011	Kleinschmidt Energy & Water Resource Consultants 141 Main St., PO Box 650 Pittsfield, Maine 04967 Telephone: (207) 487-3328 Fax: (207) 487-3124 www.KleinschmidtUSA.com	









Longitudinal Plume Delta T (F)

1.52	9.51 - 11.5
1.53 - 3.5	11.6 - 13.5
3.51 - 5.5	13.6 - 15.5
5.51 - 7.5	15.6 - 17.5
7.51 - 9.5	17.6 - 19.5

Scale: AS SHOWN	First Light & Power Holyoke, MA	FIGURE
Project No: 1503-037	Mt Tom Response to EPA	
Filename: LongProfile1.mxd	Longitudinal Plume (1)	
Drawn By: KPN		17
Date Drawn: 04-23-2011	Kleinschmidt Energy & Water Resource Consultants	

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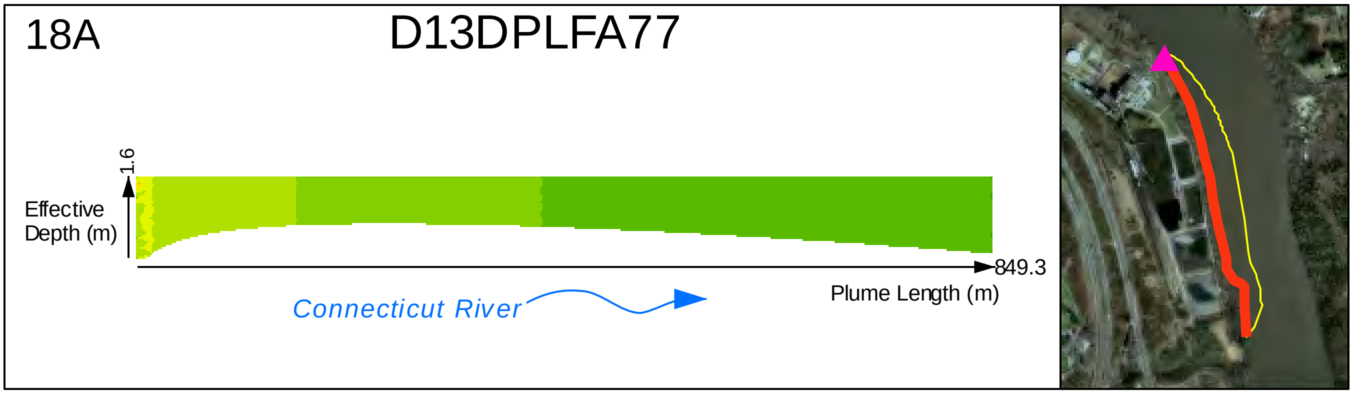
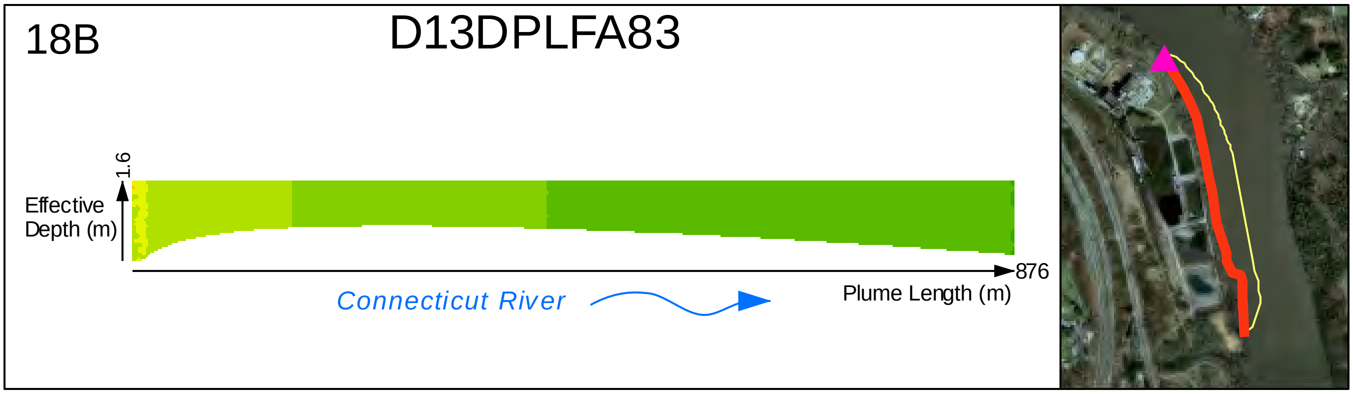
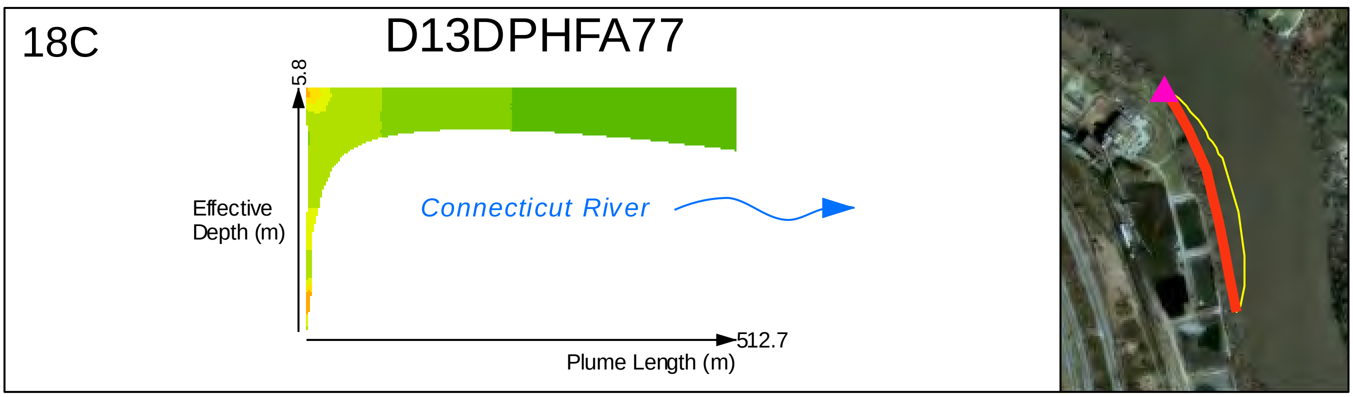
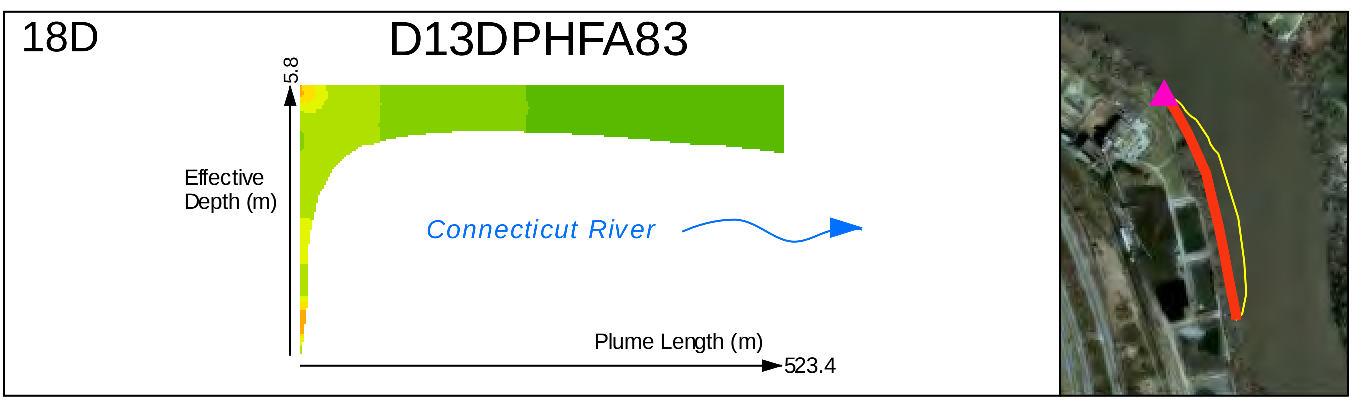




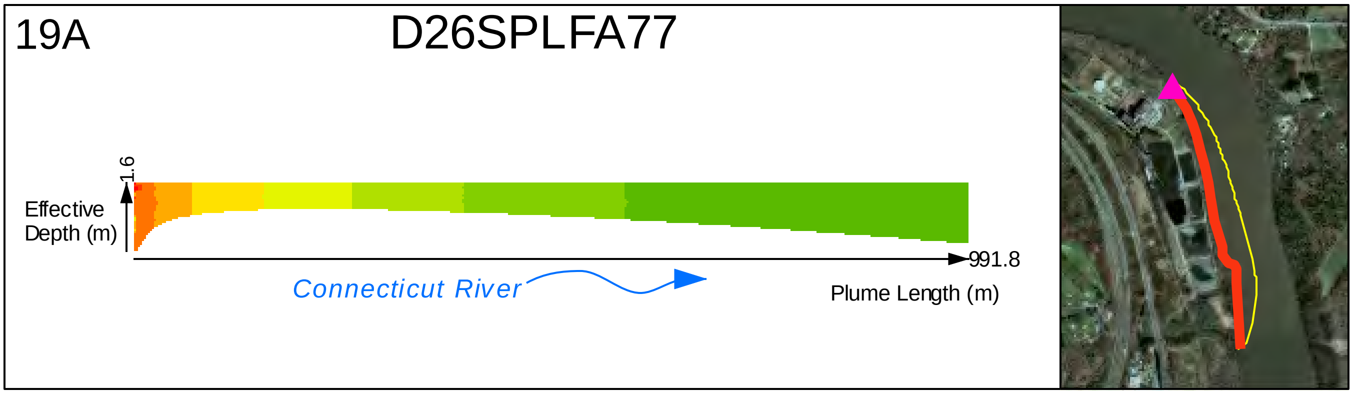


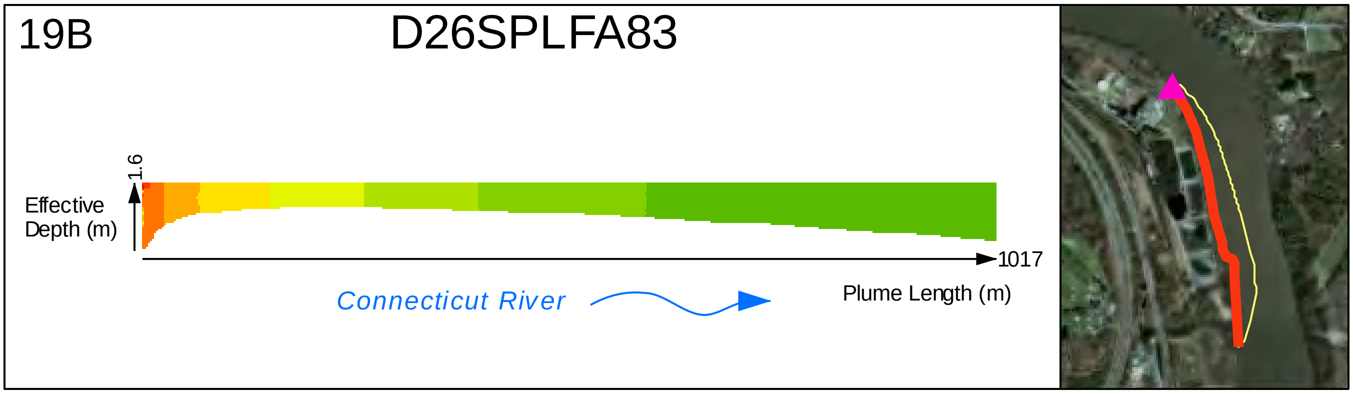


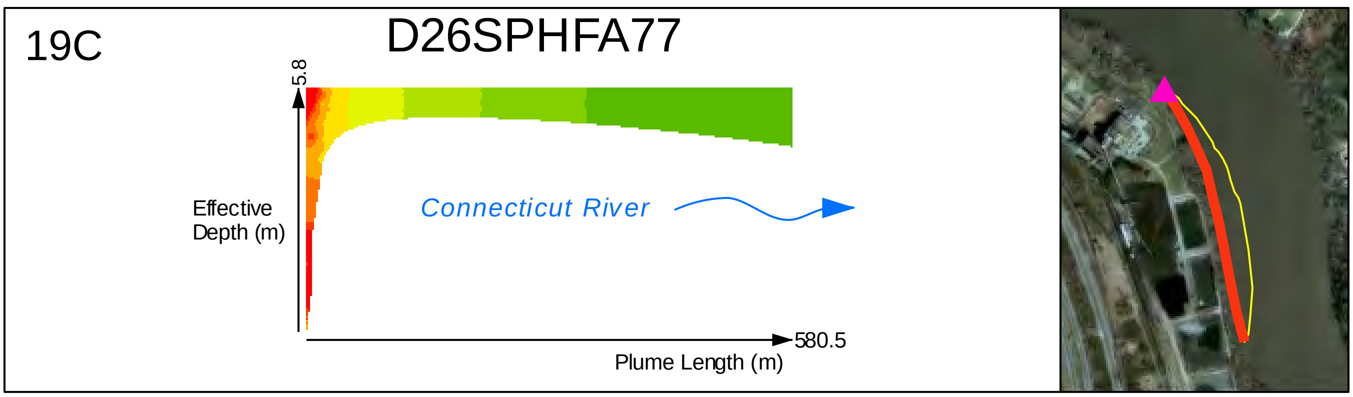
Longitudinal Plume Delta T (F)

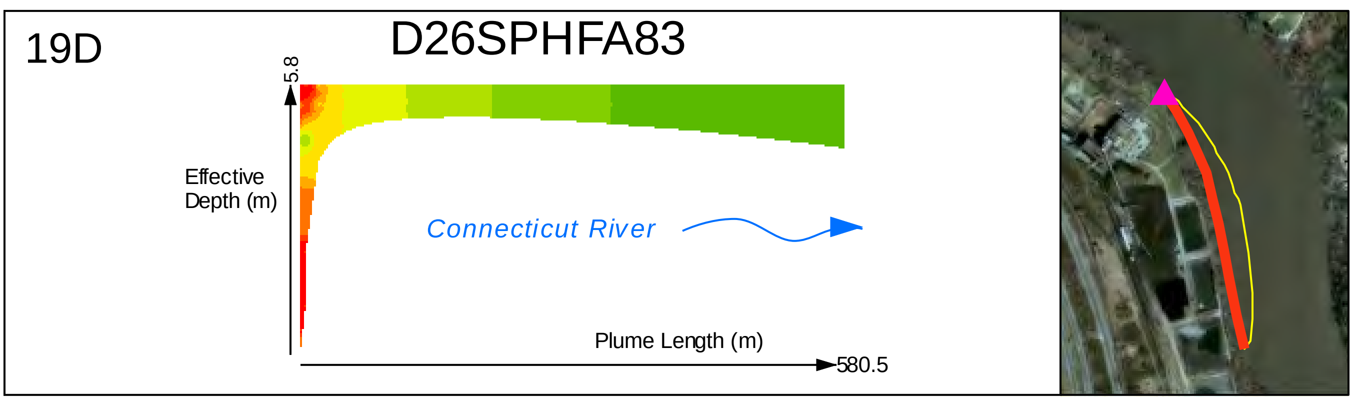
- 1.52
- 1.53 - 3.5
- 3.51 - 5.5
- 5.51 - 7.5
- 7.51 - 9.5
- 9.51 - 11.5
- 11.6 - 13.5
- 13.6 - 15.5
- 15.6 - 17.5
- 17.6 - 19.5

Scale: AS SHOWN	First Light & Power Holyoke, MA	FIGURE
Project No: 1503-037	Mt Tom Response to EPA	
Filename: LongProfile2.mxd	Longitudinal Plume (2)	
Drawn By: KPN	Kleinschmidt Energy & Water Resource Consultants	18
Date Drawn: 04-23-2011	141 Main St., PO Box 650 Pittsfield, Maine 04967 Telephone: (207) 487-3328 Fax: (207) 487-3124 www.KleinschmidtUSA.com	





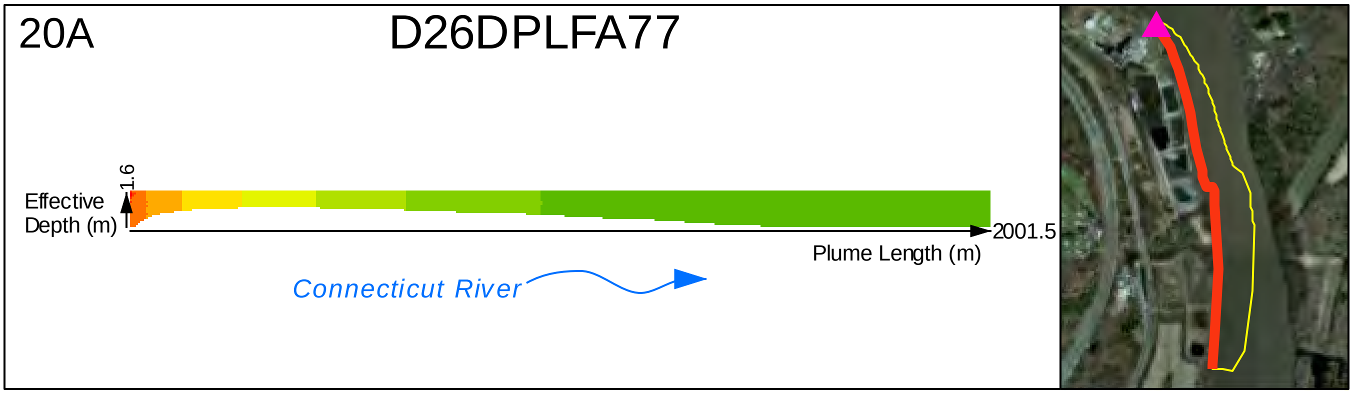


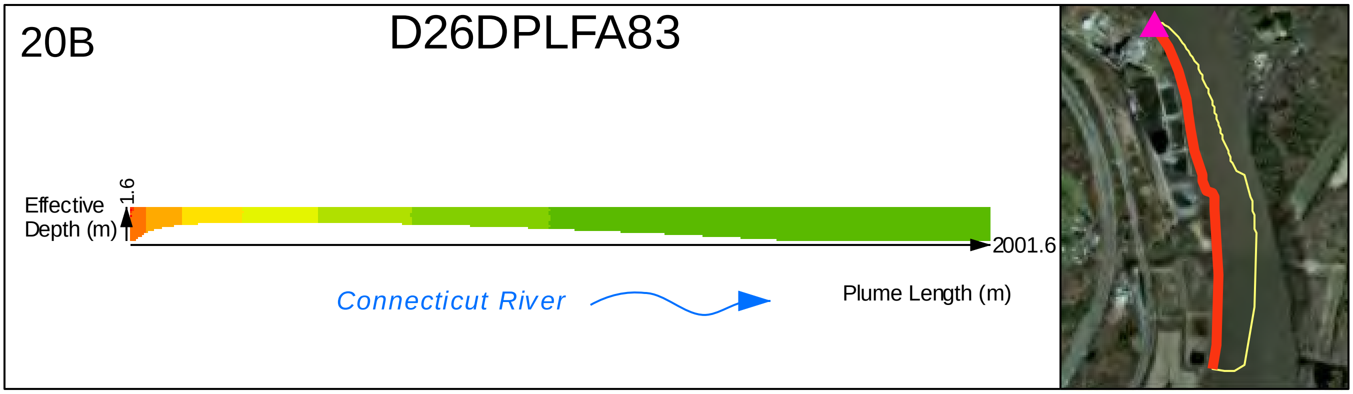


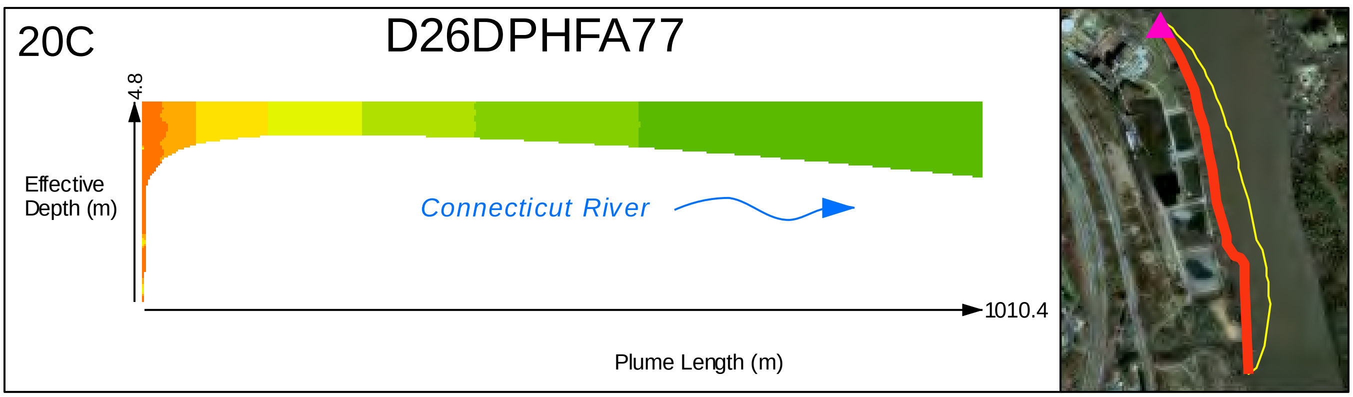
Longitudinal Plume Delta T (F)

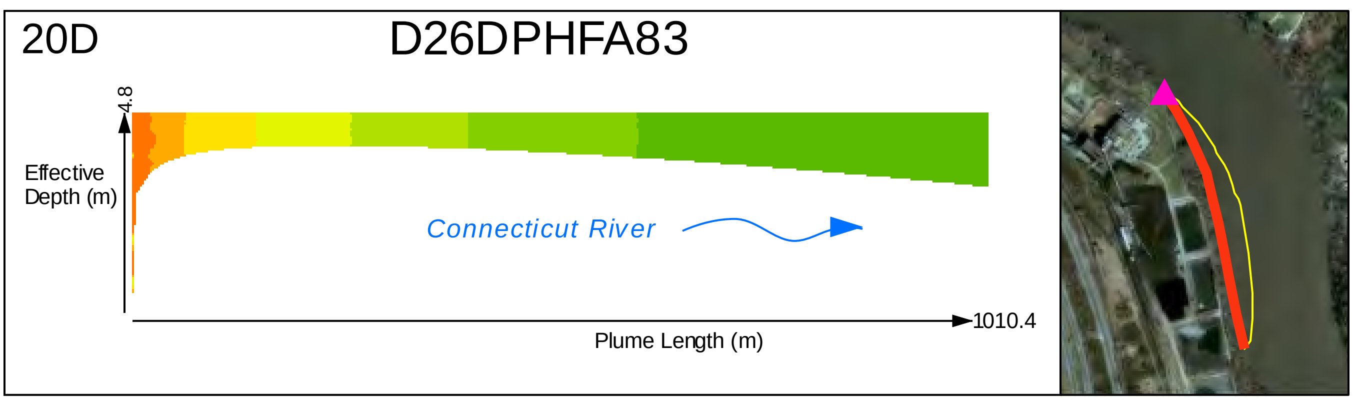
1.52	9.51 - 11.5
1.53 - 3.5	11.6 - 13.5
3.51 - 5.5	13.6 - 15.5
5.51 - 7.5	15.6 - 17.5
7.51 - 9.5	17.6 - 19.5

Scale: AS SHOWN	First Light & Power Holyoke, MA	FIGURE
Project No: 1503-037	Mt Tom Response to EPA	
Filename: LongProfile2.mxd	Longitudinal Plume (2)	
Drawn By: KPN	Kleinschmidt Energy & Water Resource Consultants 141 Main St., PO Box 650 Pittsfield, Maine 04967 Telephone: (207) 487-3328 Fax: (207) 487-3124 www.KleinschmidtUSA.com	19
Date Drawn: 04-23-2011		









Longitudinal Plume Delta T (F)

1.52	9.51 - 11.5
1.53 - 3.5	11.6 - 13.5
3.51 - 5.5	13.6 - 15.5
5.51 - 7.5	15.6 - 17.5
7.51 - 9.5	17.6 - 19.5

Scale: AS SHOWN	First Light & Power Holyoke, MA	FIGURE
Project No: 1503-037	Mt Tom Response to EPA	
Filename: LongProfile4.mxd	Longitudinal Plume (4)	
Drawn By: KPN	Kleinschmidt Energy & Water Resource Consultants 141 Main St., PO Box 650 Pittsfield, Maine 04967 Telephone: (207) 487-3328 Fax: (207) 487-3124 www.KleinschmidtUSA.com	20
Date Drawn: 04-23-2011		


N
Connecticut River
Legend
Discharge
D16CT5KA82 Delta T (F)
1.5
1.51 - 3.5
3.51 - 5.5
5.51 - 7.5
7.51 - 9.5
9.51 - 11.5
11.6 - 13.5
13.6 - 15.5
0 5 10 20 Meters
Scale: AS SHOWN
Project No: 1503-037
Filename: D26SPLFA83_plan.mxd
Drawn By: KPN
Date Drawn: 04-22-2011
FirstLight Power Resources Power Services, LLC.
Holyoke, MA
Response to EPA
Information Request
D16C5KA82
PLAN VIEW
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Energy & Water Resource Consultants
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FIGURE
21

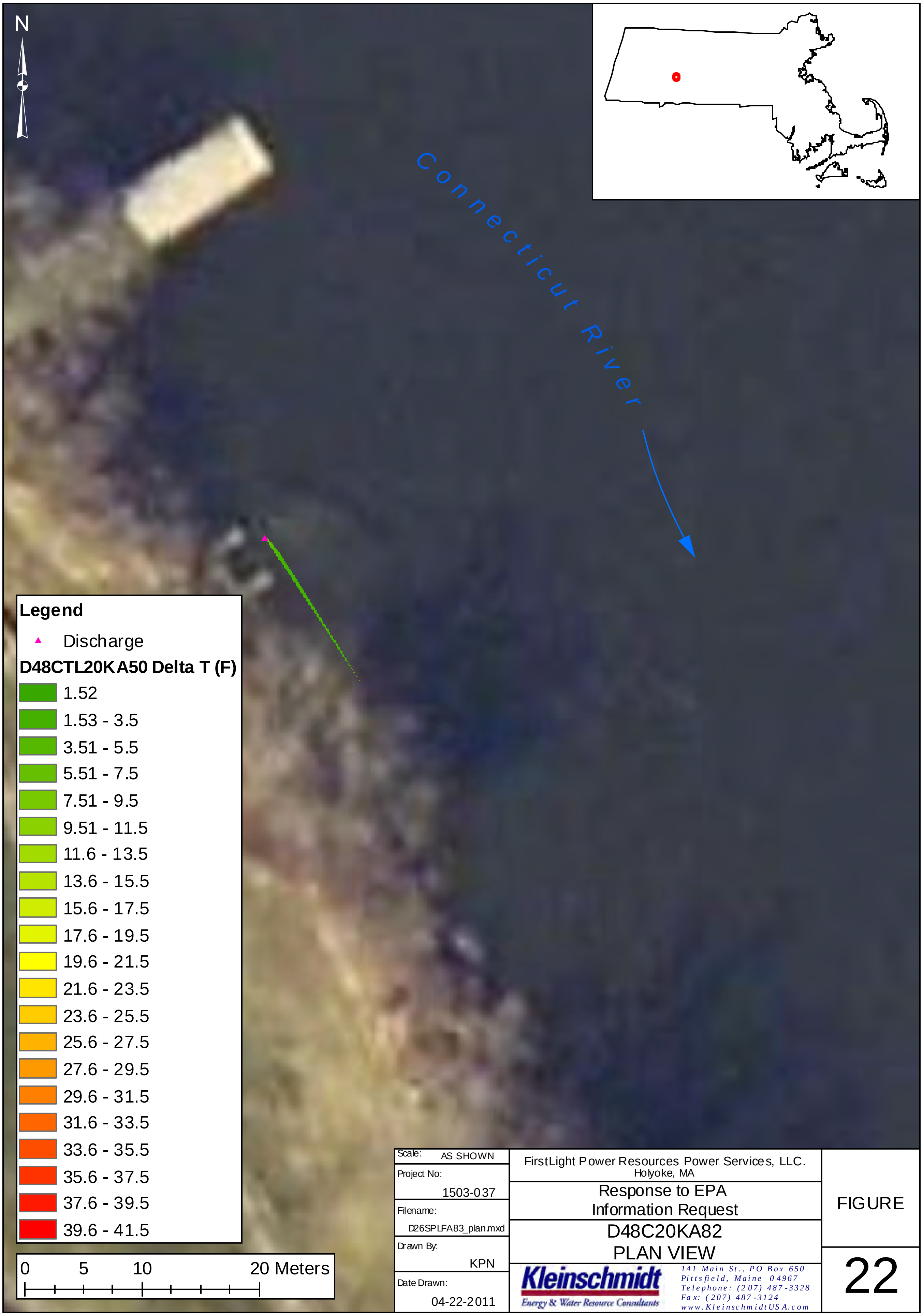
N
Connecticut River
Legend
Discharge
D48CTL20KA50 Delta T (F)
1.52
1.53 - 3.5
3.51 - 5.5
5.51 - 7.5
7.51 - 9.5
9.51 - 11.5
11.6 - 13.5
13.6 - 15.5
15.6 - 17.5
17.6 - 19.5
19.6 - 21.5
21.6 - 23.5
23.6 - 25.5
25.6 - 27.5
27.6 - 29.5
29.6 - 31.5
31.6 - 33.5
33.6 - 35.5
35.6 - 37.5
37.6 - 39.5
39.6 - 41.5
0 5 10 20 Meters
Scale: AS SHOWN
Project No: 1503-037
Filename: D26SPLFA83_plan.mxd
Drawn By: KPN
Date Drawn: 04-22-2011
FirstLight Power Resources Power Services, LLC.
Holyoke, MA
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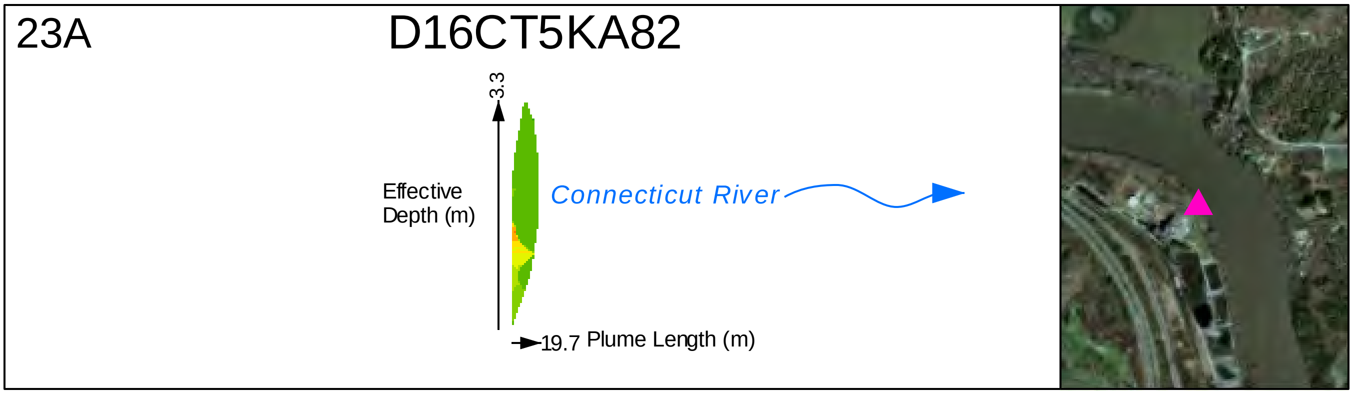
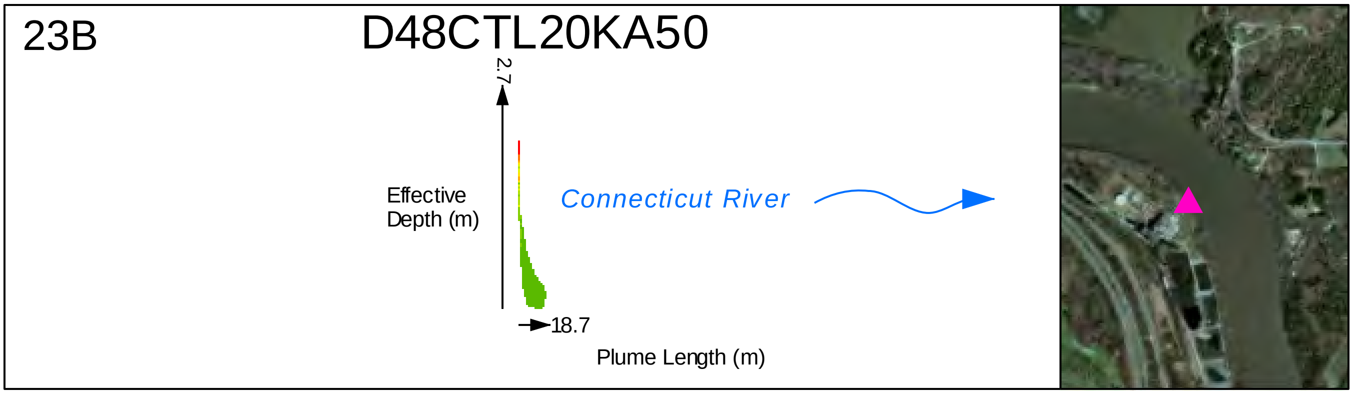
FIGURE
22





Longitudinal Plume Delta T (F)

1.52	9.51 - 11.5
1.53 - 3.5	11.6 - 13.5
3.51 - 5.5	13.6 - 15.5
5.51 - 7.5	15.6 - 17.5
7.51 - 9.5	17.6 - 19.5

Scale: AS SHOWN	First Light & Power Holyoke, MA	FIGURE
Project No: 1503-037	Mt Tom Response to EPA	
Filename: LongProfile4.mxd	Longitudinal Plume (5)	
Drawn By: KPN	Kleinschmidt Energy & Water Resource Consultants 141 Main St., PO Box 650 Pittsfield, Maine 04967 Telephone: (207) 487-3328 Fax: (207) 487-3124 www.KleinschmidtUSA.com	23
Date Drawn: 04-23-2011		